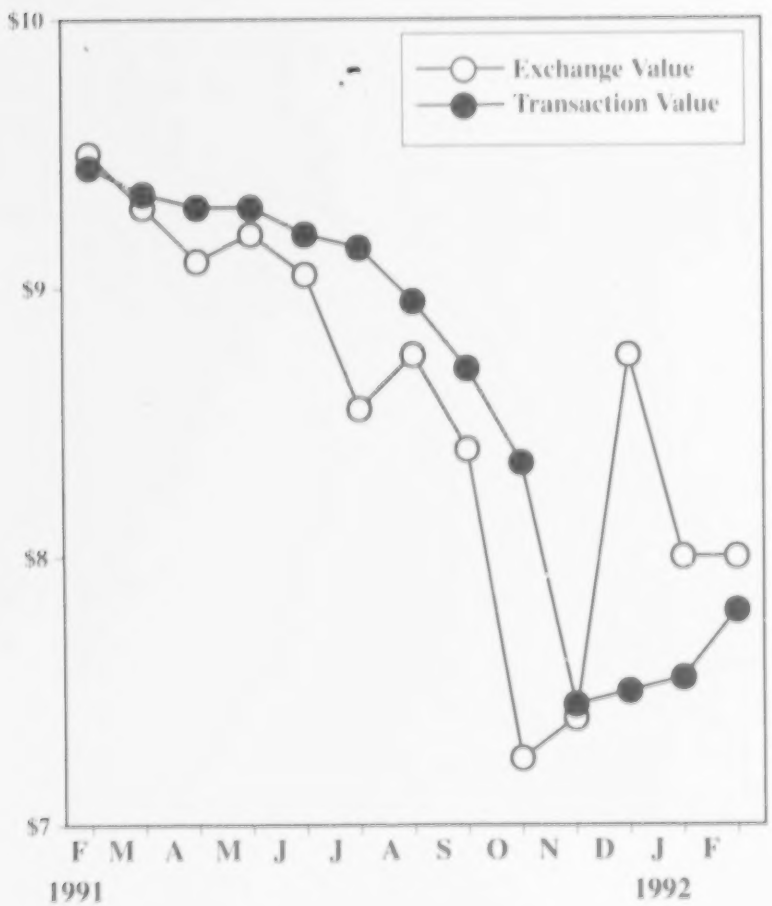
NUEXCO

Monthly Report

March 1992 **Number 283**

Mexico 15

Uranium Deposits in the Republic of Niger 22



NUEXCO

International Headquarters

Oren L. Benton – Chairman and Chief Executive Officer
Earl E. Hoellen – President and Chief Operating Officer

Three Park Central, Suite 1000
1515 Arapahoe Street
Denver, Colorado 80202 USA

Telephone: (303) 899-4500
Fax: (303) 899-4555
Telex: 450202 (NUEXCO)

Service Locations

DENVER, COLORADO, USA
Three Park Central, Suite 1000
1515 Arapahoe Street
Denver, Colorado 80202
Telephone: (303) 899-4500
Fax: (303) 899-4555
Telex: 450202 (NUEXCO)

LONDON, ENGLAND
CONCORD Resources, Ltd.
The Exchange
71 Victoria Street
London, SW1H 0HW England
Telephone: (44-71) 233-3083
Fax: (44-71) 233-3085
Telex: 267139 (299935 CCC G)

SAN FRANCISCO, CALIFORNIA, USA
Building 1, Suite 105
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Fax: (415) 854-2115
Telex: 470674 (NUEXCO SF)

HONG KONG
1408 Shui On Centre
6-8 Harbour Road
Wanchai, Hong Kong
Telephone: (852) 824-3312
Fax: (852) 824-3320
Telex: 67206 (CNITC)

ZURICH, SWITZERLAND
NUEXCO Exchange AG
Leberngasse 15
4603 Olten, Switzerland
Telephone: (41-62) 320032
Fax: (41-62) 321450
Telex: 981600 (NUXCH)

WASHINGTON, D.C., USA
11 Dupont Circle,
Suite 505
Washington, D.C. 20036
Telephone: (202) 328-9250
Fax: (202) 328-6699
Telex: 451691 (NUEXCO DC)

SYDNEY, AUSTRALIA
Suite 2301 – Gateway
One Macquarie Place
Sydney, New South Wales 2000
Australia
Telephone: (61-02) 247-9999
Fax: (61-02) 247-9437

NOTICE

This Report is prepared especially for Subscribers and is furnished to them for their use only. Except for internal use by Subscribers, no part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of NUEXCO. Neither this Report, nor copies of any portion thereof, may be lent, sold or given to non-Subscribers.

The information in this Report was gathered from sources NUEXCO believes to be accurate. However, NUEXCO makes no warranty, express or implied, and assumes no legal liability or responsibility for the accuracy, completeness or usefulness of any information contained herein.

© 1992 NUEXCO

ISSN 0742-4582

NUEXCO Monthly Report

March 1992
No. 283

Published by:
NUEXCO
Three Park Central
Suite 1000
1515 Arapahoe Street
Denver, Colorado 80202 USA
Telephone: (303) 899-4500
Fax: (303) 899-4555
Telex: (303) 450202 (NUEXCO)

Managing Editor
Treva E. Klingbiel

Assistant Editor
Kenten D. Lindberg

Production
Alan L. Wolcott

Subscriptions
Angie F. Garcia

TABLE OF CONTENTS

Market Review 1
- Market Values Summary
- February Market Review
- Current Market Data

Recent Developments 12
- Washington Focus
- Industry Briefs

Focus 15
- **Mexico**

On July 29, 1990, Mexico became the twenty-sixth country to generate electricity with a nuclear power plant, when its Laguna Verde 1 reactor reached commercial operation. The country's heavy reliance on oil and gas has led the government to continue to pursue its nuclear program, despite construction delays and financial challenges.

Raw Materials 22
- **Uranium Deposits in the Republic of Niger**

Operating the world's largest underground mine at Akouta, and a large open-pit operation at Arlit, Niger is one of the major uranium producers of the world. In addition, the country has numerous other undeveloped uranium deposits. Uranium is Niger's leading export commodity, accounting for about one-third of the country's export earnings.

Nuclear Industry Calendar 31

Historical Market Data 33

Government Statistics 40

© NUEXCO 1992

NUEXCO

To Our Readers

NUEXCO will be hosting a hospitality suite at the US Council for Energy Awareness Fuel Cycle '92 Conference to be held March 22-25 in Charleston, South Carolina. We look forward to seeing you there.

© NUEXCO 1992

NUEXCO

MARKET REVIEW

Market Values Summary

NUEXCO Market Values	This Report February 29, 1992	Last Report January 31, 1992	12 Months Ago February 28, 1991
EXCHANGE VALUE [1]	**$8.00** / lb equivalent U_3O_8	$8.00	$9.50
UF_6 VALUE [2]	**$24.25** / kg U as UF_6	$24.50	$27.75
LOAN RATE [3]	**3.0%** / annum	3.0%	3.5%
CONVERSION VALUE [4]	**$1.60** / lb U as UF_6	$1.60	$1.45
SWU VALUE [5] **(0.3 % tails assay)**	**$70** / SWU	$71	$50
TRANSACTION VALUE [6]	**$7.80** / lb equivalent U_3O_8	$7.55	$9.45
Transactions	**23**	28	18
Months	**3**	3	3
Millions of Pounds	**6.6**	8.5	2.6

DEFINITIONS

1 The **Exchange Value** is NUEXCO's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

2 The **UF_6 Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

3 The **Loan Rate** is NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

4 The **Conversion Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

5 The **SWU Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

6 The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:

a) Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;

b) At least ten transactions;

c) Transactions involving a sum total of at least 2 million pounds equivalent U_3O_8.

DERIVATIONS AND COMMENTS

- All **Market Values** are expressed in terms of US$.
- All **Market Values** are based on:
  - Data from recently completed transactions.
  - Data from pending transactions.
  - Firm bids to buy or borrow, and firm offers to sell or lend.
  - Prices purchasers or rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to buy or borrow and prices sellers or rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to sell or lend.
- Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these **Market Values**.
- In the determination of prices, NUEXCO does not consider charges for transportation other than that customarily provided by suppliers.
- The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
- For the **SWU Value**, NUEXCO converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U^{235} and a product assay of 3.0 weight-percent U^{235}, assuming feed costs corresponding to the NUEXCO **Exchange Value** and **Conversion Value** determined as of the same date.
- In calculating the **Transaction Value**, NUEXCO does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future **Exchange Values** or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it can not currently be determined.
- The sample time for the **Transaction Value** is extended as necessary to satisfy the minima for the number of transactions and quantity of material. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

© NUEXCO 1992

NUEXCO

MARKET REVIEW

FEBRUARY MARKET REVIEW

(as of February 29, 1992)

OVERVIEW

Neither buyers nor sellers were particularly aggressive during February, as they sought indicators of future market direction. As a result, the February 29, 1992, Exchange Value was unchanged at $8.00 per pound U_3O_8. Nevertheless, the market was fairly active with a total of nine uranium transactions reported. Average transaction size was small, as market participants were cautiously anticipating the next price move. Seven of the transactions involved concentrates, and all were priced at or near the current Exchange Value.

The UF_6 Value slipped $0.25, to $24.25 per kgU as UF_6, reflecting increased competition among sellers. One transaction was reported involving a small quantity of natural UF_6. No long-term uranium transactions were reported.

The Conversion Value was unchanged at $1.60 per pound U as UF_6. One intermediate-term sale was reported for a large quantity of conversion services. The Loan Rate remained unchanged at 3.0 percent per annum. No loans were reported.

Table 1
NEAR-TERM URANIUM SALES SUMMARY

	February 1992		Year-to-Date	
	No. of Sales	Volume [1]	No. of Sales	Volume [1]
Concentrates	7	1.0	15	2.6
Natural UF_6	1	0.1	1	0.1
EUP	1	0.1	2	0.1
Total [2]	**9**	**1.2**	**18**	**2.8**

[1] Million pounds equivalent U_3O_8
[2] Due to independent rounding, columns may not equal total.

Renewed competition among sellers led the SWU Value to decline one dollar, to $70 per SWU. One transaction was reported involving a small quantity of enriched uranium product (EUP).

February's nine sales of natural and enriched uranium totalled over 1.2 million pounds equivalent U_3O_8 (**Table 1**). This brings the year-to-date total to 18 sales and almost 2.8 million pounds equivalent U_3O_8, representing an average quantity per purchase of some 150 thousand pounds. The tendency thus far in 1992 is for buyers to purchase smaller quantities per transaction. By comparison, during 1991, the average transaction involved almost 270 thousand pounds. The lower average quantities purchased so far this year reflects the uncertainty of the current market and the consequent cautious reactions by both buyers and sellers.

NATURAL URANIUM AND CONVERSION

The February 29, 1992, **Exchange Value** remained at **$8.00** per pound U_3O_8, marking the first time since April 1990 that the Exchange Value was unchanged from the previous month. With the outcome of the anti-dumping petition against the former Soviet Union unknown, both buyers and sellers were reluctant to make substantial commitments and spent the month seeking indicators of future market direction. Adding to the uncertainty, some suppliers appeared to enter and exit the market randomly.

Much of February's demand came from discretionary buyers who purchased only moderate quantities. Sellers were also cautious. As a result, market volume was modest in February, and prices hovered near $8.00 per pound U_3O_8 during the entire month.

© NUEXCO 1992

Seven concentrates sales were reported in February, totalling slightly more than 1.0 million pounds equivalent U_3O_8. Six of the seven buyers were North American; the other was European. Utilities, producers, and intermediaries all made purchases, primarily from US and European intermediaries. All seven of the concentrates sales were concluded at price levels at or near the February 29 Exchange Value.

* * *

The **UF_6 Value** edged down $0.25, to **$24.25** per kgU as UF_6. Increased UF_6 supply led to heightened competition among sellers, which resulted in the price dip. UF_6 is now selling at a slight discount compared to the sum of the values of its components—concentrates and conversion. Only one natural UF_6 transaction was reported; a US utility purchased a small quantity of UF_6 for delivery in early 1993 from an intermediary.

* * *

No long-term uranium sales were reported in February. However, at month end, four utilities were evaluating long-term offers totalling 7.8 million pounds equivalent U_3O_8 for delivery during the period 1992-2000.

* * *

The **Transaction Value** climbed $0.25, to **$7.80** per pound U_3O_8, based on 23 transactions over three months involving 6.6 million pounds equivalent U_3O_8. The removal of November's low-priced sales from the three-month, weighted moving average was the primary reason for the increase in the Transaction Value.

* * *

Comparatively stable price levels near eight dollars per pound attracted interest from both buyers and sellers in February. Although they were wary and did not rush to conclude sales, their entry into the market boosted **active uranium supply** by nearly 900 thousand pounds, to **3.9** million pounds equivalent U_3O_8, and also boosted **active uranium demand** by almost 600 thousand pounds, to **2.1** million pounds equivalent U_3O_8. The supply/demand ratio slipped slightly, to 1.9.

* * *

The **Loan Rate** remained unchanged at **3.0** percent per annum. Active loan supply jumped to 8.4 million pounds equivalent U_3O_8, and demand remained minimal in comparison (**Table 2**). No loans were reported in February.

* * *

The **Conversion Value** remained **$1.60** per pound U as UF_6, although prices have tended to be slightly higher in Europe. One intermediate-term transaction was reported in which a utility purchased a large quantity of conversion services for delivery within the next two years.

Table 2
NEAR-TERM SUPPLY/DEMAND SUMMARY

	Active Supply[1]	Active Demand[1]
• Uranium (thousand lbs equivalent U_3O_8)	3,940	2,115
• Supply/Demand Ratio:	1.9	
• Loan (thousand lbs equivalent U_3O_8)	8,420	500
• Conversion (thousand lbs U as UF_6)	3,080	1,100
• SWU (thousand SWUs)	530	175

[1] Supply and Demand tables in the Market Review section of this Report provide details for each category.

© NUEXCO 1992

ENRICHMENT SERVICES AND ENRICHED URANIUM PRODUCT

After a year of steadily rising prices, the **SWU Value** reversed direction, at least temporarily, and declined one dollar, to **$70** per SWU. The decline reflected renewed competition among sellers in two areas. First, government-stockpiled material has re-emerged in the market, and the appearance of these supplies has raised new questions about the quantities of SWU available in the secondary market. Secondly, it became apparent that some primary enrichers are newly active in the spot market at competitive price levels.

Only one near-term enrichment transaction was reported. A US utility purchased EUP containing small amounts of equivalent feed and SWU. No long-term enrichment transactions were reported.

Table 3
ENRICHMENT PRICES
(February 29, 1992)

Prices	This Month Report 283	Last Month Report 282	12 Months Ago Report 271
NUEXCO SWU Value ($US per SWU)	70	71	50
US DOE SWU prices: ($US per SWU)			
USEC	121.50[1]	121.50[1]	117.85[2]
AFC	153.00[3]	153.00[3]	153.00[3]
Requirements	157.00[3]	157.00[3]	157.00[3]
Incentive Price (IP2)	104.67[4]	104.67[4]	100.68[5]
Calculated worth of enriched UF_6[6]: ($US per KgU as UF_6)			
2.0 w/o U^{235}	220	222	201
2.5 w/o U^{235}	309	311	277
3.0 w/o U^{235}	400	404	355
3.5 w/o U^{235}	494	498	435
4.0 w/o U^{235}	589	595	516
4.5 w/o U^{235}	686	692	598

[1] Effective 10/1/91.
[2] Effective 10/1/89 to 9/30/91.
[3] Effective since 10/1/84.
[4] Provisional IP2 for FY92: Effective 10/1/91 to 9/30/92, for up to 30% of annual requirements.
[5] IP2: Effective 10/1/90 to 9/30/91, for up to 30% of annual requirements.
[6] Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 w/o ^{235}U tails assay.

© NUEXCO 1992

RECENT TRANSACTIONS

Uranium Sales [1]

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U_3O_8)	Price Within Percentage Range [2] of Current Exchange or UF_6 Value	Buyer	Seller	Remarks
5359	1992	50-100	98-102	Intermediary	Intermediary	
5360	1992	301-600	98-102	Utility	Intermediary	
5367	1992	101-300	98-102	Producer	Intermediary	
5368	1993	50-100	98-102	Utility	R	UF_6
5373	1992	50-100	98-102	Utility	Intermediary	
5374	1992	50-100	98-102	Producer	R	
5376A	1992	101-300	See Remarks	Utility	Intermediary	Contained in EUP
5378	1992	Less Than 50	R	Utility	R	
5380	1992	101-300	98-102	Producer	Intermediary	

Natural Uranium Loans [1]

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U_3O_8)	Price Within Percentage Range [2] of Current Loan Rate	Borrower	Lender	Remarks
No Natural Uranium Loans are reported						

Conversion Sales [1]

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U equivalent)	Price Within Percentage Range [2] of Current Conversion Value	Buyer	Seller	Remarks
5357	1992-1993	601-1,000	103-110	Utility	R	

Enrichment Sales [1]

NUEXCO Transaction Number	Delivery Period	Approximate Quantity [3] (thousand SWU)	Price Within Percentage Range [2] of Current SWU Value [4]	Buyer	Seller	Remarks
5376B	1992	Less Than 50	See Remarks	Utility	Intermediary	Contained in EUP

R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

[1] Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

[2] The ranges *Below 90, 90-97, 98-102, 103-110, Above 110*, represent percentages (rounded to whole numbers) of the appropriate current Market Value. The endpoints of each range are included within that range.

[3] If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 % tails assay.

[4] Prices are usually normalized to 0.30 % tails assay. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

© NUEXCO 1992

NUEXCO

MARKET REVIEW

SUPPLY AND DEMAND

Uranium Supply

NUEXCO Project Number	Quantity (Thousand Pounds equivalent U_3O_8) Spot or Near-term [1]	Intermediate or Long-term [2]	Delivery Period	Remarks
AVAILABLE TO PURCHASE:				
ACTIVE				
91-1505	500	—	1992	
91-1506*	750	—	1992	U_3O_8/UF_6
91-1507	500	—	1992	
91-1511	260	—	1992	UF_6
91-1512	785	—	1992	UF_6
92-1501A*	645	—	1992	UF_6e
90-1231	500	500 per year	1992-1995	
91-1268	—	600 per year	1992-1999	
TOTAL	**3,940**			
INACTIVE	**4,930**			
AVAILABLE TO LOAN:				
ACTIVE				
91-1084*	3,900	—	—	U_3O_8
92-1008	495	—	—	UF_6
92-1017	900	—	—	U_3O_8
92-1060*	915	—	—	UF_6
92-1502*	210	—	—	UF_6
92-1503*	2,000	—	—	U_3O_8
TOTAL	**8,420**			
INACTIVE	**1,000**			

* New or revised since last month.

[1] For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.

[2] For delivery beyond one year, measured from the date of this Report.

Active Projects reclassified as Inactive since last month: *none*
Active Projects removed since last month: *none*

© NUEXCO 1992

SUPPLY AND DEMAND

Uranium Demand

NUEXCO Project Number	Quantity (Thousand Pounds equivalent U_3O_8) Spot or Near-term [1]	Intermediate or Long-term [2]	Delivery Period	Remarks
INQUIRIES TO PURCHASE:				
ACTIVE				
91-1247	500	—	1992	UF_6
92-1000	390	—	1993	UF_6
92-1043*	250	—	1992	U_3O_8/UF_6
92-1047*	5	—	1992	UF_6
92-1059A*	445	—	1992	UF_6e
92-1061*	400	—	1992	
92-1063*	125	—	1992	
91-1118	—	300 per year	1993-1998	U_3O_8/UF_6
91-1184	—	350 per year	1993-1997	
91-1290	—	310 per year	1995-1999	U_3O_8/UF_6
91-1294	—	250 per year	1996-2000	
92-1015	—	1,300 per year	1995-2004	
92-1032*	—	200 per year	1996-1998	U_3O_8/UF_6
91-1197	—	2,210	1992-1997	U_3O_8/UF_6
91-1227A	—	60	1992-1994	UF_6e
91-1232A	—	500	1993-1994	UF_6e
91-1283	—	5,225	1994-2000	U_3O_8/UF_6
92-1030	—	5,500	1992-1993	U_3O_8/UF_6
TOTAL	**2,115**			
INACTIVE	**2,125**			
INQUIRIES TO BORROW:				
ACTIVE				
92-1505*	500	—	—	U_3O_8
TOTAL	**500**			
INACTIVE	*None reported*			

* New or revised since last month.

[1] For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.

[2] For delivery beyond one year, measured from the date of this Report.

Active Projects reclassified as Inactive since last month: *none*
Active Projects removed since last month: 91-1021, 91-1297, 92-1027, 92-1029A, 92-1034

© NUEXCO 1992

SUPPLY AND DEMAND

Conversion Supply and Demand

NUEXCO Project Number	Quantity (Thousand Pounds U as UF_6) Within 3 Years[1]	Beyond 3 Years[1]	Delivery Period	Remarks
AVAILABLE FOR SALE:				
ACTIVE				
91-1500	440	—	1992	
91-1501	440	—	1992	
92-1506*	1,100	—	1992	
92-1507*	1,100	—	1992	
TOTAL	**3,080**			
INACTIVE	*None reported*			
INQUIRIES TO PURCHASE:				
ACTIVE				
92-1508*	1,100	—	1992	
91-1299	—	330	1993-1997	
TOTAL	**1,100**			
INACTIVE	**620**			

* New or revised since last month.

[1] Measured from the date of this Report.

Active Projects reclassified as Inactive since last month: 91-1275
Active Projects removed since last month: 91-1174

© NUEXCO 1992

SUPPLY AND DEMAND

SWU Supply And Demand

NUEXCO Project Number	Quantity (Thousand SWUs) Spot or Near-term [1]	Intermediate or Long-term [2]	Delivery Period	Remarks
AVAILABLE FOR SALE:				
ACTIVE				
91-1509	200	—	1992	
91-1515	200	—	1992	
92-1501B*	130	—	1992	UF6e
TOTAL	**530**			
INACTIVE	**685**			
INQUIRIES TO PURCHASE:				
ACTIVE				
92-1031	70	—	1992	UF6e
92-1035*	5	—	1992	UF6e
92-1059B*	100	—	1992	UF6e
90-1196	—	60 per year	1995 on	
91-1142	—	75 per year	1995-2000	
92-1016	—	170 per year	1996-2006	
91-1152	—	2,700	1995-2001	
91-1171	—	560	1995-1998	
91-1227B	—	35	1992-1994	UF6e
91-1232B	—	500	1993	UF6e
91-1250	—	45	1993	UF6e
92-1024*	—	12	1993	
TOTAL	**175**			
INACTIVE	**195**			

* New or revised since last month.

[1] For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.

[2] For delivery beyond one year, measured from the date of this Report.

Active Projects reclassified as Inactive since last month: 92-1029B
Active Projects removed since last month: 92-1058

© NUEXCO 1992

NUEXCO

MARKET REVIEW

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

Exchange Value[1]

Country (currency)	per lb equivalent U_3O_8 as Concentrates			per kg U as Concentrates		
	This Month (Feb 29, 1992)	Last Month (Jan 31, 1992)	12 Months Ago (Feb 28, 1991)	This Month (Feb 29, 1992)	Last Month (Jan 31, 1992)	12 Months Ago (Feb 28, 1991)
Australia (dollar)	10.61	10.66	12.10	27.59	27.71	31.46
Belgium (franc)	269.91	265.78	297.62	701.69	690.97	773.74
Canada (dollar)	9.46	9.40	10.94	24.60	24.43	28.44
EC (ecu)	6.41	6.31	7.06	16.66	16.41	18.36
Finland (markka)	36.03	35.16	34.84	93.66	91.41	90.58
France (franc)	44.60	43.96	49.18	115.95	114.29	127.86
Germany (mark)	13.11	12.90	14.46	34.09	33.55	37.60
Italy (lira)	9,840	9,696	10,802	25,582	25,207	28,082
Japan (yen)	1,035	1,006	1,254	2,692	2,616	3,261
Netherlands (guilder)	14.75	14.52	16.30	38.36	37.75	42.37
So. Africa (comm. rand)	22.75	22.42	24.39	59.15	58.27	63.41
So. Korea (won)	6,028	6,113	6,812	15,672	15,892	17,708
Spain (peseta)	826.28	811.61	900.13	2,148	2,110	2,340
Sweden (krona)	47.56	46.87	53.64	123.65	121.84	139.46
Switzerland (franc)	11.90	11.48	12.50	30.95	29.84	32.50
Taiwan (dollar)	198.40	200.00	253.65	515.79	519.96	659.44
UK (pound)	4.56	4.48	4.95	11.85	11.65	12.88
US (dollar)	8.00	8.00	9.50	20.80	20.80	24.70

Transaction Value[1]

Country (currency)	per lb equivalent U_3O_8 as Concentrates			per kg U as Concentrates		
	This Month (Feb 29, 1992)	Last Month (Jan 31, 1992)	12 Months Ago (Feb 28, 1991)	This Month (Feb 29, 1992)	Last Month (Jan 31, 1992)	12 Months Ago (Feb 28, 1991)
Australia (dollar)	10.35	10.06	12.04	26.90	26.15	31.30
Belgium (franc)	263.16	250.83	296.05	684.15	652.10	769.67
Canada (dollar)	9.23	8.87	10.88	23.99	23.05	28.29
EC (ecu)	6.25	5.96	7.02	16.24	15.49	18.26
Finland (markka)	35.13	33.18	34.66	91.32	86.27	90.10
France (franc)	43.49	41.49	48.92	113.05	107.86	127.19
Germany (mark)	12.78	12.18	14.39	33.24	31.66	37.40
Italy (lira)	9,594	9,150	10,745	24,943	23,789	27,934
Japan (yen)	1,009	949.81	1,248	2,624	2,469	3,244
Netherlands (guilder)	14.39	13.70	16.21	37.40	35.62	42.15
So. Africa (comm. rand)	22.18	21.15	24.26	57.67	55.00	63.08
So. Korea (won)	5,877	5,769	6,776	15,280	14,998	17,615
Spain (peseta)	805.62	765.95	895.40	2,094	1,991	2,328
Sweden (krona)	46.37	44.23	53.36	120.56	114.99	138.72
Switzerland (franc)	11.61	10.83	12.44	30.18	28.17	32.33
Taiwan (dollar)	193.44	188.75	252.32	502.90	490.71	655.97
UK (pound)	4.44	4.23	4.93	11.55	10.99	12.81
US (dollar)	7.80	7.55	9.45	20.28	19.63	24.57

[1] As of May 1991 Report #273; calculated using currency exchange rates for the last business day of the month, as published in *The Wall Street Journal*. Prior to May 1991 Report #273; calculated using currency exchange rates published in *The Wall Street Journal* on the last business day of the month.

© NUEXCO 1992

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

Conversion Value[1]

Country (currency)	per lb U as UF_6			per kg U as UF_6		
	This Month (Feb 29, 1992)	Last Month (Jan 31, 1992)	12 Months Ago (Feb 28, 1991)	This Month (Feb 29, 1992)	Last Month (Jan 31, 1992)	12 Months Ago (Feb 28, 1991)
Australia (dollar)	2.12	2.13	1.85	4.68	4.70	4.07
Belgium (franc)	53.98	53.16	45.43	119.01	117.19	100.15
Canada (dollar)	1.89	1.88	1.67	4.17	4.14	3.68
EC (ecu)	1.28	1.26	1.08	2.83	2.78	2.38
Finland (markka)	7.21	7.03	5.32	15.89	15.50	11.72
France (franc)	8.92	8.79	7.51	19.67	19.38	16.55
Germany (mark)	2.62	2.58	2.21	5.78	5.69	4.87
Italy (lira)	1,968	1,939	1,649	4,339	4,275	3,635
Japan (yen)	207.07	201.28	191.47	456.50	443.75	422.12
Netherlands (guilder)	2.95	2.90	2.49	6.51	6.40	5.48
So. Africa (comm. rand)	4.55	4.48	3.72	10.03	9.88	8.21
So. Korea (won)	1,206	1,223	1,040	2,658	2,695	2,292
Spain (peseta)	165.26	162.32	137.39	364.33	357.86	302.89
Sweden (krona)	9.51	9.37	8.19	20.97	20.66	18.05
Switzerland (franc)	2.38	2.30	1.91	5.25	5.06	4.21
Taiwan (dollar)	39.68	40.00	38.72	87.48	88.18	85.35
UK (pound)	0.91	0.90	0.76	2.01	1.98	1.67
US (dollar)	1.60	1.60	1.45	3.53	3.53	3.20

SWU Value And UF_6 Value[1]

Country (currency)	SWU Value at 0.30 % Tails Assay			UF_6 Value per kg U as UF_6		
	This Month (Feb 29, 1992)	Last Month (Jan 31, 1992)	12 Months Ago (Feb 28, 1991)	This Month (Feb 29, 1992)	Last Month (Jan 31, 1992)	12 Months Ago (Feb 28, 1991)
Australia (dollar)	92.88	94.60	63.69	32.17	32.64	35.35
Belgium (franc)	2,362	2,359	1,566	818.15	813.95	869.36
Canada (dollar)	82.81	83.39	57.58	28.69	28.78	31.96
EC (ecu)	56.07	56.02	37.16	19.42	19.33	20.62
Finland (markka)	315.24	312.05	183.37	109.21	107.68	101.77
France (franc)	390.25	390.15	258.85	135.20	134.63	143.66
Germany (mark)	114.74	114.52	76.12	39.75	39.52	42.24
Italy (lira)	86,101	86,050	56,850	29,828	29,693	31,552
Japan (yen)	9,059	8,932	6,602	3,138	3,082	3,664
Netherlands (guilder)	129.10	128.86	85.78	44.73	44.46	47.61
So. Africa (comm. rand)	199.09	198.94	128.37	68.97	68.65	71.25
So. Korea (won)	52,747	54,252	35,850	18,273	18,721	19,897
Spain (peseta)	7,230	7,203	4,738	2,505	2,486	2,629
Sweden (krona)	416.17	415.93	282.33	144.17	143.53	156.69
Switzerland (franc)	104.17	101.88	65.80	36.09	35.16	36.52
Taiwan (dollar)	1,736	1,775	1,335	601.39	612.50	740.93
UK (pound)	39.87	39.75	26.07	13.81	13.72	14.47
US (dollar)	70.00	71.00	50.00	24.25	24.50	27.75

[1] As of May 1991 Report #273; calculated using currency exchange rates for the last business day of the month, as published in *The Wall Street Journal*. Prior to May 1991 Report #273; calculated using currency exchange rates published in *The Wall Street Journal* on the last business day of the month.

© NUEXCO 1992

WASHINGTON FOCUS

by Linda L. Gunter

In February, Congress began consideration of the President's FY1993 budget. DOE's budget request will be discussed throughout the month of March, as House committees with jurisdiction hold hearings. Energy Secretary James Watkins began the DOE budget review process with testimony on February 25 before the Energy & Power subcommittee of the House Energy & Commerce Committee. By the end of March, the House Appropriations Committee is expected to conclude its hearings on the Energy & Water Appropriations bill, which funds DOE's programs.

Senate Energy Bill Passed

On February 19, the Senate completed its consideration of a comprehensive energy package, voting 94-4 in favor of the bill. Sponsored by Senators J. Bennett Johnston (D-LA) and Malcolm Wallop (R-WY), the bill was renumbered S 2166, after two controversial titles concerning opening the Arctic National Wildlife Refuge (ANWR) to oil drilling and Corporate Average Fuel Economy (CAFE) standards were removed. The remaining fourteen titles include provisions for nuclear plant licensing reform, uranium enrichment restructuring, and promotion of construction of standardized advanced reactor designs. Other titles concerning energy efficiency standards and reform of the Public Utilities Holding Company Act (PUHCA) are not included, but may be attached when the House begins consideration of the bill.

An amendment to the bill was approved allowing AVLIS to be licensed under *10 CFR Part 50* regulations, rather than *10 CFR Parts 40* and *70*. Those regulations apply to other fuel cycle facilities, including Louisiana Energy Services (see Monthly Report No. 267, November 1990). As a new technology, AVLIS can benefit from the extra time required by a two-step licensing process allowed under *Part 50*. Under this section, the Nuclear Regulatory Commission (NRC) may begin licensing with design information rather than a completed enrichment facility.

The House version of an omnibus energy bill, HR 776, has twelve titles, including provisions that restructure DOE's uranium enrichment program and outline licensing reform, but these titles are substantially different from the Senate's version. During a subcommittee hearing on DOE's FY 1993 budget request, Energy & Commerce Committee Chairman John Dingell (D-MI) stated that he intends to announce shortly his committee's mark-up schedule for HR 776. Reportedly this session could begin in March. Because of the substantial differences between the Senate and House versions of their energy bills, if the House passes its energy bill this year, it is likely a conference committee will be convened to try to arrive at a consensus energy package.

Proposed NRC Regulations on Fuel Cycle Facility Licenses

The NRC has published NUREG 1324 entitled "Proposed Method for Regulating Major Materials Licensees". The report makes public the findings of a Materials Regulatory Review Task Force convened to propose an "ideal method for regulating these licensees, unfettered by any existing regulations or regulatory guidance." The task force was convened after the NRC investigated a potential criticality incident at General Electric's fabrication facility in Wilmington, NC, but focused on all fuel cycle facilities in light of problems at other plants.

© NUEXCO 1992

The task force concluded that current fuel cycle regulations do provide adequate safeguards, but that the safety regulations designed to protect workers and the public focus "almost exclusively on radiological safety concerns, practically to the exclusion of process safety and managerial controls." The task force concluded that the incidents occurring in the industry recently are more related to managerial lapses. Thus, the group proposed that NRC regulations be accompanied by a detailed standard format and content guide, and a standard review plan. The publications would define the topics and level of detail an applicant must cover in its application for a license.

The task force also considered more prescriptive requirements in *10 CFR Parts 30, 40,* and *70* and developed a general design criteria for major materials licensees. The report notes that the absence of guidance for the licensees makes it more difficult for the public to participate in the licensing process. The report also notes "As long as the focus of the regulations pertaining to large materials processors remains concentrated on radiological safety, NRC's attention to the adequacy of managerial controls (training of operators, process safety reviews, use of written procedures, proper sampling of materials to ensure meaningful measurements, change control over processes and procedures) will continue to languish. Lack of managerial controls contributed to both the Sequoyah Fuels event (1986) and the General Electric Plant incident (1991)".

The report adds that the NRC has more than 150 active regulatory guides pertinent to fuel cycle and materials licensing. More than 70 percent of these guides were issued at least ten years ago, and 50 percent were issued at least fifteen years ago. The task force believes these guides should be updated and revised regularly, perhaps every five years. The report recognizes that the volume of work required for the standards would represent a significant investment of staff time and technical assistance. However, the report did not note that since Congress had passed legislation authorizing collection of a user fee from nuclear utilities to fund 100 percent of the NRC's budget, the industry subject to this increased regulation would pay for any additional staff or expense caused by this new initiative. Because of the very nature of the NRC's responsibility to protect public health and safety, it is unlikely the industry can protest the new regulatory initiative without being accused by the public of trying to avoid higher safety standards. NRC staff has asked for public comment on NUREG 1324 by the end of April 1992.

© NUEXCO 1992

INDUSTRY BRIEFS

South Africa Announces Plans to Test Laser Enrichment

The Atomic Energy Corporation of South Africa, Ltd. recently announced that it plans to test a prototype molecular laser isotope separation (MLIS) enrichment unit by 1994. The tests will examine the economic and technical parameters of an MLIS plant, which uses lasers to excite molecules, rather than individual uranium atoms as used in the AVLIS process under development in the USA and France. South Africa also had been pursuing research efforts on centrifuge enrichment, but has ceased that work and decided to focus on MLIS development.

◆ ◆ ◆

Czech Utility and French Firm to Establish Joint-Venture

Ceske Energeticke Zavody (CEZ), a Czech utility, and SGN, a French engineering firm owned primarily by Cogema, have agreed to set up a joint-venture by the end of 1992 to provide engineering and project management services. The venture will focus on a much-needed program of investment in energy generation and distribution facilities in the Czech and Slovak Federal Republic, but also will offer numerous other technical services.

US Uranium Industry Not Viable for Seventh Consecutive Year

In January, Secretary of Energy James Watkins determined that the US domestic uranium industry was not viable in 1990. The determination was based on data supplied by DOE's Energy Information Administration and criteria established by Congress. This marks the seventh consecutive year (since 1984) that the industry has been declared non-viable.

◆ ◆ ◆

Yankee Rowe to Close

On February 26, Yankee Atomic Electric Company's Board of Directors voted to close permanently its 167-MWe PWR at Rowe, Massachusetts. The oldest operating reactor in the USA (it began operation in 1961) was closed due to economics and safety concerns about reactor vessel embrittlement.

The reactor initially was shut down voluntarily October 1, in response to an NRC staff recommendation requesting detailed analysis on the reactor's response under certain accident scenarios. After several months of evaluation, Yankee estimated that it could spend at least $23 million more on analysis. Moreover, even that might not ensure restart of the plant or address all the issues, since the regulatory criteria for restart has still not been agreed to by the NRC and Yankee. Given this situation, and the plant's higher operating costs, the Board decided to close the plant. Decommissioning plans and related activities have already begun.

Taiwan Progresses Toward Approval of Two More Nuclear Plants

In February, the Taiwan government approved plans to proceed with construction of the country's seventh and eighth nuclear units. Early in the month, the Ministry of Economic Affairs recommended that planning work on the units resume, and shortly thereafter the Executive Yuan (Cabinet) provided its endorsement as well. The last major hurdle for the project will be getting approval from the Legislative Yuan to reactivate previously frozen funds of US$316 million for preparatory work on the units. Plans for the two 1,000 MW units have been deferred for over five years.

◆ ◆ ◆

Trojan to Restart with New Tube Plugging Criterion

The US Nuclear Regulatory Commission (NRC) has approved new steam generator tube plugging criterion for Portland General Electric Company's Trojan nuclear plant. As a result, the 1,095-MWe PWR will be allowed to restart. The new criterion will determine the seriousness of a crack not by crack depth, but by voltage measurements from eddy current tests. This allows the utility to disregard microscopic, deep cracks that do not affect the integrity of the tube. The NRC also may publish a generic communication regarding the topic.

© NUEXCO 1992

MEXICO

On July 29, 1990, Mexico became the twenty-sixth country to generate electricity with a nuclear power plant, when its Laguna Verde 1 reactor reached commercial operation. Officially named the United Mexican States, the country is a federal democratic republic with 31 states and one federal district. The country has vast natural resources, with large reserves of natural gas and oil. Mexico is the world's fourth largest producer of oil and the primary supplier of oil to the United States. The country has a rapidly growing population, currently exceeding 80 million, and as a result, has growing energy demands. Mexico relies on oil for more than 50 percent of its electrical energy needs, and hydroelectric for over 25 percent. This heavy reliance on oil has led the government to seek to diversify its supply sources and to reduce its CO_2 emissions. As a result, Mexico has continued to pursue its nuclear program, despite construction delays and financial challenges.

ELECTRICITY SUPPLY

Mexico's population is not only growing quickly, but shifting to urban areas as well. This growth, combined with the change in concentration of the population, has led to very rapid growth in energy demand. In the 1980s, electricity demand grew at an average annual rate exceeding six percent, but varied from two to eight percent per year. Electricity demand is currently forecast to grow at over seven percent per year during the 1990s.

Mexico's national utility, Comisión Federal de Electricidad (CFE), has pursued a number of options to meet the rising demand. Its primary fuel source for electricity generation is, and will remain, oil. Although the country's national energy plan (Programa Nacional de Modernizacion Energetica) calls for reduced CO_2 emissions and for CFE to develop other energy sources, well over half of the country's electricity throughout most of the 1990s still will be fueled by oil. This actually represents significant progress, as Mexico relied on oil for 90 percent of its energy as recently as 1985. The current energy plan forecasts almost 34,000 MWe of installed electrical-generating capacity by the mid-1990s.

The other major facet of Mexico's energy plan is to increase efficiency in electricity consumption. The enormous foreign debt the country incurred during its expansion in the 1970s remains an onerous burden and has limited development. Thus, conservation and improved efficiency are key elements in satisfying demand and conserving the country's limited capital resources. The government's moves toward economic liberalization in recent years have stimulated Mexico's economy and resulted in a renewed positive environment for foreign investment.

Following oil, hydroelectric power is the next most important source of electricity in Mexico, generating over one quarter of the country's total output. While there still are untapped resources, much of this potential hydroelectric capacity is not economic, given its large distance from population centers.

Mexico has large coal reserves, but most are of lower quality and, given the emphasis on lowering CO_2 emissions, not well-suited for power station utilization. Nevertheless, in seeking to diversify its supply sources and reduce its reliance on oil, Mexico has built several coal-fired stations (its first large station, 1,200 MWe, started operation in 1982) and has plans for further expansion. Mexico imports coal for these stations, which currently represent about 4.5 percent of total installed generating capacity. These stations, along with conservation and improved efficiency, will have the largest impact on meeting Mexico's growing energy needs in the 1990s.

Geothermal energy also is being used to meet the increased energy demand, and already accounts for 2.7 percent of total capacity at present. In addition, Mexico will rely on independent power producers in the near-term to supply about eight percent of the country's total electricity generation.

In the longer term, Mexico plans to enlarge the role of geothermal power and nuclear power. Several hundred geothermal sites already have been identified, but development is costly and many years away. Once Laguna Verde 2, Mexico's second nuclear plant, begins operation in 1994, nuclear power will represent approximately five percent of the country's total generating capacity.

© NUEXCO 1992

NORTH AMERICAN FREE-TRADE AGREEMENT

In 1988, Carlos Salinas de Gortari was elected Mexico's president, and he began aggressively implementing market reforms to focus his country on the growing international economy. In addition to privatizing several once-nationalized companies, Salinas boldly pushed for a free-trade agreement with the USA. In the spring of 1991, the US Congress granted "fast-track" status to the free-trade negotiations, allowing the US trade representative to negotiate a treaty directly with Mexico and then have the US Congress vote on the entire treaty as a complete package. In February 1991, Canada signed as a full party to the negotiations, which will be known as the North American Free Trade Agreement. President Salinas of Mexico has been active in the negotiations, and has worked to ensure that the principle concerns of environmental protection, health and safety of workers, and a fear of the loss of US manufacturing jobs will be successfully solved.

Early concerns over Mexico's prohibition of foreign-owned mineral resources projects were alleviated when Mexico revised its mining laws to permit foreign investors to own 100 percent of an operating mining project for up to 12 years. (However, uranium deposits have been excluded from this change, as the mineral is considered strategic.) Nevertheless, the possibility of a North American free-trade zone including Canada, the USA, and Mexico has created optimism for renewed economic growth that will enable Mexico to handle its current financial difficulties and go forward with major development projects, such as new power plants.

NUCLEAR POWER

Mexico established its National Commission for Nuclear Energy (CNEN) in 1956, as its first step toward adopting nuclear power. During the 1960s, CFE solicited offers for nuclear stations and examined several potential sites. By 1972, the country had selected General Electric to supply one 640-MWe boiling water reactor at Laguna Verde, approximately 70 kilometers north of the city of Veracruz, on the Gulf of Mexico (**Figure 1**). One year later, CFE exercised an option to purchase a second unit. Construction on the station did not begin until 1976, and organizational, political, and economic problems led to extensive construction delays. Unit 1 finally began commercial operation in July 1990.

Organization

CFE reports to the Ministry of Energy and Mines (Secretaría de Energía, Minas e Industria Paraestatal-SEMIP), which also controlled the Institute for Nuclear Energy, the successor to the CNEN. In 1979, the Institute was divided by law into three major organizations. Uranio Mexicano (Uramex) was responsible for managing the country's fuel cycle. It was established to develop a uranium industry for Mexico, but due to the slow progress of the country's nuclear program and a weak uranium market, Uramex was dissolved in 1985. The National Nuclear Research Institute is the organization that handles all nuclear research and development. The third organization is the National Nuclear Safety and Safeguards Commission (CNSNS), which is responsible for nuclear regulatory functions. It also is responsible for Mexico's safeguards and non-proliferation efforts. Mexico has assumed an active role in this area and was instrumental in the establishment of the Treaty for the Prohibition of Nuclear Weapons in Latin America (Tlatelolco Treaty).

CFE is responsible for the design, construction, and operation of all Mexico's power-generating stations, including its nuclear power plants. The utility has managed construction and has also been involved in the design of both Laguna Verde units. It also handles fuel procurement for the station in all phases of the nuclear fuel cycle.

Laguna Verde Station

CFE has been involved with the Laguna Verde project since its inception. Financing for construction of the station was provided by internationally sourced loans warranteed by the Export/Import Bank. Construction of Unit 1 began in 1976 and was completed in 1987. Like many projects in the USA and elsewhere, construction was delayed by a combination of political, regulatory, and economic/financial factors, and even by a change of the architect-engineering firm (Ebasco replaced Burns & Roe in 1976, about the time construction began). The unit received a favorable review by an International Atomic Energy Agency OSART inspection (Operational Safety and Review Team) in late 1987, but political considerations delayed fuel loading until October 1988. The unit was connected to the grid in April 1989, and reached full power on March 17, 1990. It was declared in commercial operation on July 29, 1990.

© NUEXCO 1992

Figure 1
MEXICO's NUCLEAR STATION and IMPORTANT URANIUM DISTRICTS

From early on, CFE took advantage of international expertise to improve the future performance of its first nuclear plant. Unit 1 received OSART visits in 1980, and twice in 1987. CFE accepted information from the Institute of Nuclear Power Operators (INPO) about the start-up of Unit 1 and about emergency planning for the station. CFE is also a founding member of the World Association of Nuclear Operators (WANO), which provided input on how to operate the plant effectively. In addition, plant management developed a working relationship with the Cofrentes plant (939-MWe BWR) in Spain, gaining valuable insight on operating a similar unit.

After numerous delays in construction and fuel loading, Unit 1 finally sustained criticality on February 5, 1989, but CFE experienced additional delays during the start-up of the reactor. In April 1989, CFE shut down the reactor for four days to improve the coolant water quality, even though technical specifications had not been exceeded. CFE's efforts focused on reactor coolant water cleanliness and conductivity, which had been affected by oxidation in the system. Start-up of the turbine and synchronization to the grid went well; it was expected to take 10-12 days, yet was accomplished in only three. So while start-up of Unit 1 took much longer than planned, serious problems were limited, and its performance in terms of number of scrams was comparable to an average plant start-up in the USA.

© NUEXCO 1992

Table 1
NUCLEAR POWER UNITS IN MEXICO

Units In Operation

Unit	Lead Utility or Fuel Buyer	Capacity (MWe net)	Type	COD[1]	1991 Capacity Factor (percent)	Total 1991 Electricity Generation (GWh net)
Laguna Verde 1	CFE[2]	640	BWR	1990	72	4,022

Units Under Construction

Unit	Lead Utility or Fuel Buyer	Capacity (MWe net)	Type	Projected COD	Percent Complete
Laguna Verde 2	CFE	640	BWR	1994	72

[1]COD= Commercial Operation Date
[2]CFE =Comisión Federal de Electricidad

The additional time made available by the delayed start-up allowed more time for training, which apparently paid off: Unit 1 set a new record by staying on-line for 250 consecutive days from its first commercial operation date. In its record run, which broke the record held by Philadelphia Electric's Limerick 1 plant, Laguna Verde 1 generated over 5,700 GWh before shutting down for its first scheduled refueling. It achieved a capacity factor of over 88 percent during the first cycle. The refueling went smoothly, taking 72 days. The unit was back at full power by November 12, 1991, and by year end, had generated 4,022 GWh during 1991 and achieved a capacity factor of 72 percent for the year (**Table 1**).

Laguna Verde 2, a twin of Unit 1, is 72 percent complete and commercial operation is now planned for 1994. Unit 2 faces the same challenges that faced Unit 1; however, CFE remains committed to the plant's completion and has increased its rate of progress on the unit in recent years. CFE also now uses a simulator built at the Laguna Verde site to train operators.

Opposition to nuclear power in Mexico was quite active during construction of the plant, but the unit's operational success has quieted most opponents, since most of the opposition was motivated by politics or environmental concerns. CFE operates an information center at the Laguna Verde station and promotes visits by the public to enhance good relations with the local population.

Future Plans

During the 1970s, Mexico's national energy plans envisioned 20,000 MWe of installed nuclear capacity by the year 2000. But the collapse of oil prices in the 1980s and the country's resulting economic crisis caused the cancellation of virtually all of these plans. The most recent national energy plan (1990-1994) calls for the completion of the Laguna Verde station. Studies on the feasibility of constructing additional reactors have projected that perhaps as much as 6,900 MWe of new nuclear capacity could be on-line by 2010. While this may seem optimistic, the excellent performance thus far of Laguna Verde 1, and Mexico's need to use its oil to power over 65 percent of CFE's generating capacity as well as create foreign exchange through oil exports, mandates an increased nuclear commitment.

FUEL CYCLE CONTRACTING

CFE has responsibility for all fuel procurement for the Laguna Verde station. While officially the Ministry controls this area, it has delegated the responsibility to CFE. To date, the utility has purchased its uranium under Mexican uranium procurement laws, and it has indicated it may fill some of its future needs from domestic sources, if and when Mexico's uranium industry goes into production. Mexico is currently negotiating IAEA safeguards agreements with Canada and Australia, but has not yet finalized the agreements, thereby limiting CFE's uranium supply options.

© NUEXCO 1992

The Laguna Verde station (**Figure 2** and **Figure 3**) is operating on one-year cycles, and CFE has already acquired fuel for the first four cycles of Unit 1, as well as the initial core for Unit 2. Annual refueling outages will occur in early autumn, right after the rainy season in Mexico. This allows CFE to rely upon its hydroelectric capacity when the reservoirs are at their fullest to counterbalance the lack of nuclear capacity.

CFE's enrichment services are supplied by the US Department of Energy, to which the utility is fully committed through 1996. General Electric, the Laguna Verde reactor supplier, also supplies CFE's fuel fabrication services. The National Nuclear Research Institute is expecting to complete a pilot plant at Salazar this year that will be able to fabricate fuel elements using imported components. The plant will have the capability to produce up to twenty fuel assemblies at one time. The first four prototype fuel bundles are expected to be used in the third reload at Unit 1, scheduled for October 1993. An additional four prototype fuel bundles are expected to be included in the fourth reload.

Spent Fuel Storage

Mexico has no permanent high-level waste repository as yet, and will store its spent fuel on site. In late 1990, CFE awarded a contract to Holtec International to install super high-density spent fuel racks in pools at Units 1 and 2. The process boosted each pool's capacity to more than 3,300 assemblies, enabling the pools to hold the discharged fuel bundles for the entire expected lifetime of each reactor.

Figure 2 — Laguna Verde Nuclear Power Station

The station consists of two 640-megawatt boiling water reactors. Unit 1 began commercial operation on July 29, 1990, and operated continuously for 250 days, setting a new record for continuous first-cycle operation of a BWR. Unit 2 is under construction and more than 70 percent complete, and is planned to begin commercial operation in 1994.

© NUEXCO 1992

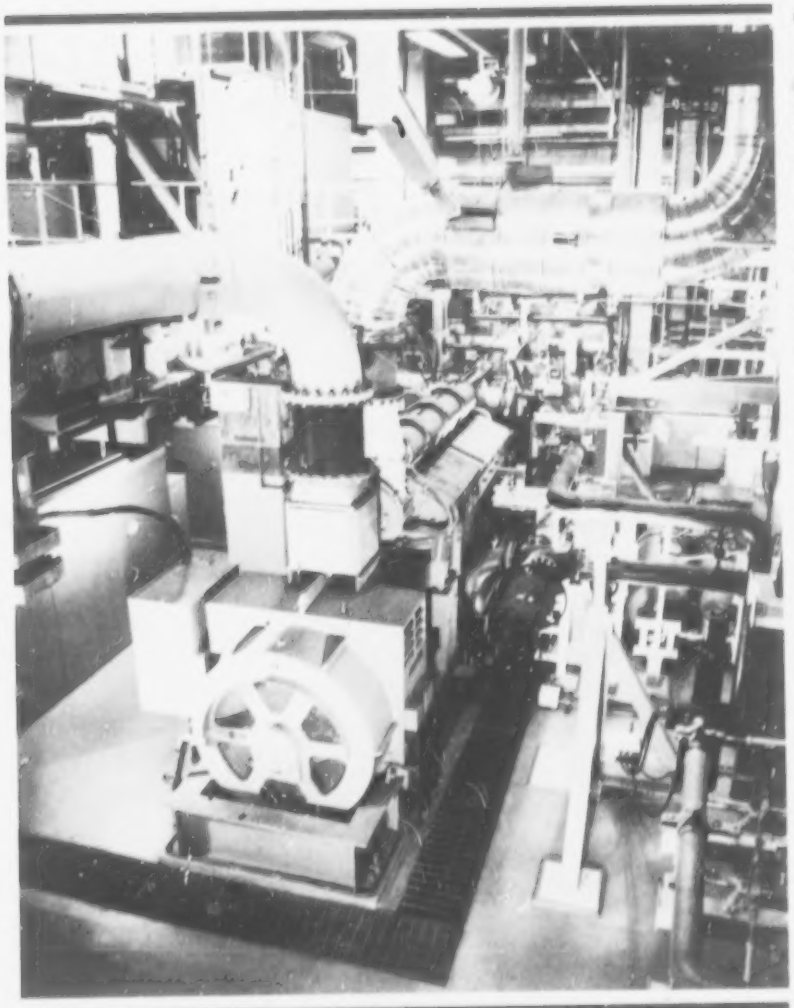


Figure 3 — Interior of Unit 1 at the Laguna Verde Nuclear Station

URANIUM RESOURCES

Uranium exploration began in Mexico in the late 1950s, with a renewed effort beginning again in 1979. But with the slowdown of the country's nuclear program, exploration had essentially ceased by 1983. Nevertheless, Mexico has identified approximately twenty million pounds equivalent U_3O_8 of reasonably assured resources, plus eight million pounds of estimated additional resources. The primary deposits are located in the states of Chihuahua and Nuevo Leon in northern Mexico, although no deposits have been commercially developed. Additional reserves have been located in Sonora, Oaxaca, Durango, Sinaloa, and Tamaulipas.

Geology

Most of the exploration activity in Chihuahua has been concentrated along the east flank of the Peña Blanca Mountains. The principal uranium district is situated 40 to 60 miles northeast of the city of Chihuahua where important mineralization occurs in volcanic rocks of Tertiary Age. The mountainous area is characterized by regional north-south faulting and localized ring faulting in caldera-related structures. Geologically, the highland area is referred to as the Aldama Platform. The same volcanic sequence was deposited upon Cretaceous limestones to the east in a structural basin referred to as the Chihuahua Trough.

The mesozoic sediments filling the Trough were subjected to intense folding, faulting, and erosion. Limestone conglomerates were formed throughout much of the region. Deposition of volcanic ash and flow material followed. Subsequent to a period of rapid erosion, minor faulting and alteration affected the volcanic material, creating favorable host conditions for uranium mineralization within volcanic remnants scattered throughout the Trough area.

Mineralization

Mineralization in the limestone has collected in faults, fractures, bedding planes, and solution cavities directly beneath the overlying Nopal Formation. Uranium mineralization in the volcanics is limited to ash-flow tuffs, and welded or reworked tuffs. It is primarily concentrated in fractures, faults and associated brecciation, and zones of high permeability and alteration, as in lenses of pumice. Uraninite is the principal ore mineral present. Uranophane occurs as an important secondary mineral in altered rock, usually associated with highly porous or brecciated zones. Ore grades range between 0.1 and 0.5 % U_3O_8.

Production

A pilot processing plant, the Villa Aldama mill, at Peña Blanca in Chihuahua operated for a brief period in the 1960s. In the late 1970s, Uramex started construction on its first commercial-scale uranium processing plant at Peña Blanca with a designed milling capacity of 650 tons of ore per day. However, the plant was never completed, as Uramex was dissolved when the government decided to shift its emphasis away from the uranium industry. The limited production from the pilot plant, as well as uranium produced as a by-product of other operations, totalled only about 100 thousand pounds equivalent U_3O_8. Deposits in the state of Nuevo León, only a few hundred miles south of Duval County, Texas, show particular promise for exploitation using in-situ leaching techniques. In addition, estimates have indicated that perhaps as little as fifteen percent of Mexico has been explored. The known deposits, combined with undiscovered resources, probably give the country the capability to develop a uranium production industry to supply an expanding domestic nuclear power program. At this time, however, Mexico is not planning any development, primarily due to low market prices for uranium.

OUTLOOK

Despite some major economic, political, and technical challenges, Mexico has achieved a place in the world nuclear community. The Laguna Verde project is a success; Unit 1 is operating well, and construction of Unit 2 continues toward a 1994 start. The potential North American Free-Trade Zone would be a great boost economically and further stimulate growth. With this growth will come an increased demand for energy, but with continued good performance at Laguna Verde and the security of a potential domestic uranium industry, CFE can continue to diversify its energy supply sources and to provide the electricity so vital for the development of an industrializing country.

URANIUM DEPOSITS IN THE REPUBLIC OF NIGER

Niger is located at the southern edge of the Sahara desert in north-central Africa. The country covers a territory of 1,267,000 square kilometers (489,191 square miles), or about three times the size of California, with a population exceeding 7.5 million people. In 1989, Niger abandoned 16 years of military rule and is now on the way to a democratic system; the first multiparty elections are scheduled for 1992. Mining industries are the primary base for Niger's economy. Uranium is the leading export commodity, with revenues accounting for about one-third of Niger's export earnings. Other mineral products include coal, tin, and small amounts of gold.

URANIUM INDUSTRY

Niger's uranium mines are located in the Agadez region of the country, approximately 850 km northeast of the capital Niamey (**Figure 1**). The mining district is about 2,000 km from both the Gulf of Benin/Atlantic Ocean and the Mediterranean Sea.

Uranium was first discovered in the Azelik region in 1957. These discoveries led to a major exploration campaign by the French conglomerate, Commissariat à l' Energie (CEA), in the Tim Mersoi sedimentary basin. The efforts resulted in the discovery of sandstone-type uranium deposits at Arlit in 1965, Akouta in 1972, and through 1979, additional discoveries at Imouraren, Afasto-Ouest (West), Tassa N' Taghalgue/Arni, Azelik, and Abakoroun, as well as a number of other deposits (**Table 1**). Expenditures for exploration through 1990 totalled almost US$190 million, with almost 90 percent of the total invested prior to 1983.

The Arlit, Arni, Akouta, and Afasto-Ouest deposits are located near one another in a 20 km-long zone. Imouraren is located approximately 80 km further south; Azelik, 160 km southwest; and Madaouela, 40 km southeast. Niger's total uranium resources recoverable at less than $30 per pound U_3O_8 have been determined as:

REASONABLY ASSURED RESOURCES (RAR)=
452 million pounds U_3O_8 (174 thousand MTU)

ESTIMATED ADDITIONAL RESOURCES (EAR)=
738 million pounds U_3O_8 (284 thousand MTU)

In the 1970s, two production centers at Arlit and Akouta were developed, along with the complete infrastructure necessary in this isolated, semi-desert region. Two mining towns also were constructed, Arlit and Akokan, totalling about 50 thousand inhabitants. A 2,000 km-long, all-weather road was specially built to connect the mining district with Agadez and Niamey in Niger, and Cotonou in Benin. Uranium concentrates are hauled by truck on this road 1,600 km to Parakou in Benin, and then 430 km by rail to Cotonou, the principal port for material shipment.

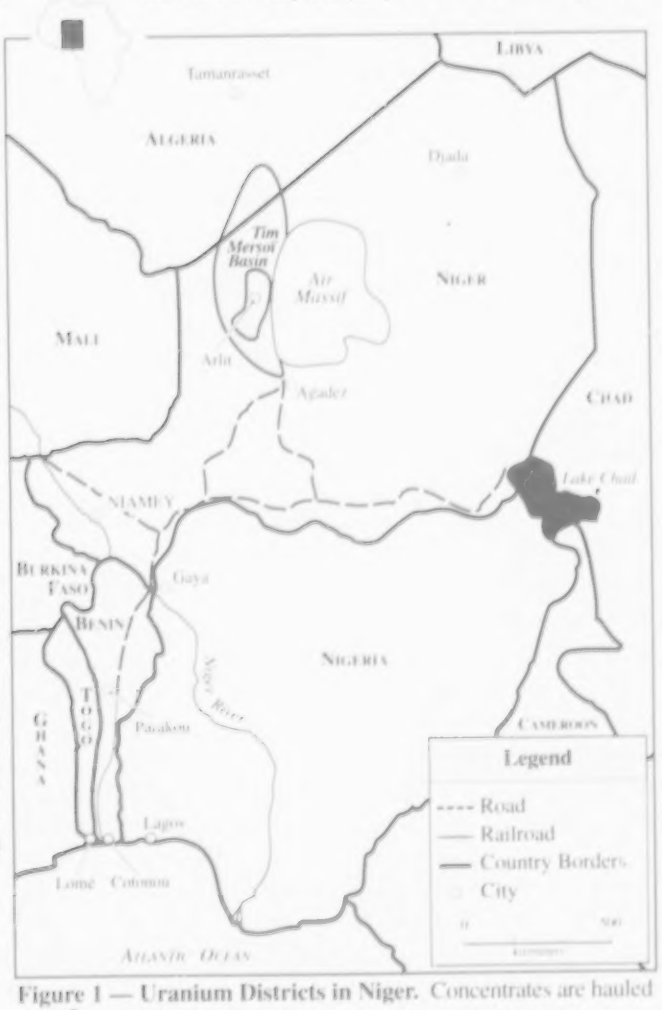


Figure 1 — Uranium Districts in Niger. Concentrates are hauled by truck to Parakou, and then by rail to Cotonou for shipping.

© NUEXCO 1992

Table 1
IMPORTANT URANIUM DEPOSITS OF NIGER

Deposit/Project	Avg. ore grade (% U_3O_8)	Estimated reserves (mill. lbs. U_3O_8)	Production Status
Akouta Project	0.5	154	in production
Arlit Project	0.3	110	in production
Imouraren	0.18	274	undeveloped
Tassa N' Taghalgue/Arni	0.29	148	undeveloped
Afasto-Ouest	0.29	83	undeveloped
Azelik/Abakoroun	0.25	36	undeveloped
Madaouela	n/a	17	undeveloped
Sekiret	0.13	10	undeveloped

Niger's total uranium production through 1991 totalled over 130 million pounds equivalent U_3O_8. The annual production rate is presently over seven million pounds U_3O_8. More than half of Niger's uranium output goes to France, primarily through purchases by Cogema. The balance of the output goes to Japanese and Spanish interests. The sales price of uranium from Arlit was 22,000 CFA francs per kgU in 1990 (approximately US$33 per pound U_3O_8 at an exchange rate of 300 CFA francs = US$1), although Cogema reportedly paid 19,000 CFA per kgU.

ARLIT AND AKOUTA OWNERSHIP

Akouta is the world's largest underground uranium mine and is owned by the consortium, Cominak (Compagnie Minière d'Akouta), which is composed of Cogema, Onarem, OURD, and ENUSA (**Table 2**). The Arlit project is a series of open-pit mines, owned by Société des Mines de l' Air (Somair), and operated by Cogema. Ownership interests in Somair are given in **Table 3**.

The government of Niger owns shares in all of the country's uranium projects through the state company Onarem (Office National des Ressources Minière). Most of Niger's undeveloped uranium deposits are owned, in conjunction with Onarem, by Cogema or other interests from Japan, Germany, Kuwait, and the UK.

Following Niger's independence from France in 1960, the government agency Uraniger was formed to administer land concessions for uranium exploration and development. Uraniger signed the original concession contracts with the French companies that form the basis of Niger's current uranium industry. Akouta and Arlit are located on one of these concessions. In an effort to become more involved in the country's uranium operations, the government established Onarem in 1976, replacing Uraniger as the coordinator and participant in all uranium exploration and development in Niger. Onarem is required by law to be a partner in all uranium ventures in the country. The company operates under the auspices of the Ministry of Mines, and also is responsible for marketing Niger's share of output.

REGIONAL CHARACTERISTICS

Geology

Niger's uranium deposits occur in sediments of the Tim Mersoi Basin that constitutes the northeast portion of the vast intracratonic Iulledem Basin. Precambrian crystalline rocks form the basement and include a variety of granitic and metamorphic facies. The facies are cut by ring structure granites, extensive acid volcanic complexes of Paleozoic age (rhyolite, tuff, ignimbrite, and Cenozoic and Quaternary trachy-phonolitic and basaltic extrusions). Alternating continental, epicontinental, and shallow marine sediments of

Table 2
COMINAK OWNERSHIP

Cogema (France)	34%
Onarem (Niger)	31%
Overseas Uranium Resources Development Company (Japan)	25%
ENUSA (Spain)	10%

Table 3
SOMAIR OWNERSHIP

Onarem (Niger)	33.0%
Cogema (France)	27.0%
Compagnie Française de Mokta[1] (France)	19.4%
Uranium Pechiney (France)	7.6%
Urangesellschaft mbH (Germany)	6.5%
Agip SpA (Italy)	6.5%

[1] Subsidiary of Cogema

© NUEXCO 1992

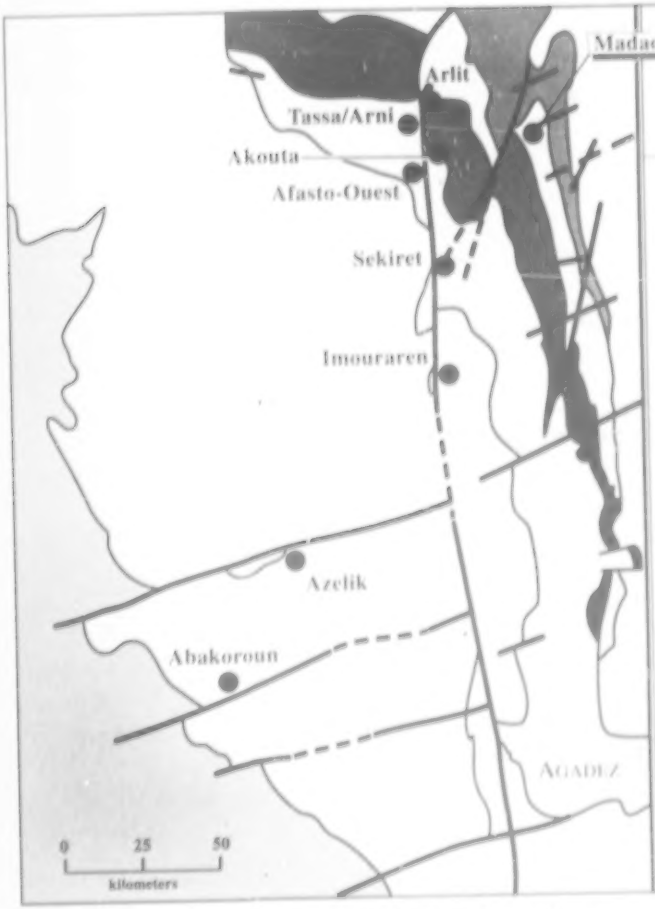


Figure 2
Tim Mersoï Basin in Northern Niger - Regional geological map with location of uranium deposits

LOWER CRETACEOUS
- Tegama Group
- L' Irhazer Group

TRIASSIC—JURASSIC
- Agadez Group

PERMIAN
- Izegouandan Series

LOWER CARBONIFEROUS
- Tagora Group
- Terada Group

PRECAMBRIAN
- Crystalline basement
- Fault
- Uranium Deposit

Carboniferous to Cretaceous age fill the Tim Mersoi Basin. The distribution of the various geologic groups within the Tim Mersoi basin is displayed in **Figure 2**, and a stratigraphic column of the uranium deposits in the basin is shown in **Figure 3**.

The sediments are composed of interstratified sequences of sandstones, arkoses, minor conglomerates, and often organic-rich claystones and shales. These sediments occur in beds ranging in size from several centimeters to tens of meters thick. Two prominent stratigraphic systems are present: a Lower to Middle Paleozoic sequence which is dominated in the uranium region by a 600 meter-thick sequence of gray Lower Carboniferous strata; and a pink sequence of Permian to Lower Cretaceous "Continental Intercalaire" (red series). Due to a sedimentological gradient, the various stratigraphic units are exposed in aureoles around the Air Massif, becoming successively younger with increasing distance from the massif. In general, the inclination of the sediments is shallow.

These features suggest that the basin was filled by slow sedimentation under fairly stable tectonical and climatological conditions lasting from the Upper Paleozoic into the Mesozoic Age. These conditions are considered critical for the formation and preservation of uranium deposits.

Mineralization

Uranium deposits in the Tim Mersoi Basin are essentially of tabular sandstone type, with local modification to stack-type mineralization along fractures. Uranium has been preferentially accumulated during two stratigraphic periods, the Carboniferous and Jurassic. Several formations of these periods have a remarkable uranium content.

Figure 3 —TIM MERSOI BASIN: STRATIGRAPHIC COLUMN WITH URANIUM DEPOSIT POSITIONS

Period	Group	Series	Formation	Lithology	U Deposit
Lower Cretaceous	Tegama			Pink Sandstone	
Jurassic	Irhazer	Dabla	Irhazer	Pink shale with sandy lenses	
	Agadez		Assaouas	Pink claystone with sandy interbeds (Gelili Sandstone)	Azelik
			Tchirézrine 2	Pink crossbedded sandstone	Imouraren, Assaouas
		Wagadi	Abinky	Pink crossbedded sandstone	
			Tchirézrine 1	Pink crossbedded sandstone	
		Goufat	Mousseden	Pink crossbedded sandstone	
			Teloua 3	Pink crossbedded sandstone	
			Teloua 2	Pink crossbedded sandstone	
Triassic		Aguelal	Teloua 1	Pink crossbedded sandstone	
Permian	Izegouanda		Moradi	Pink sandy shale	
			Tamamait	Pink and gray shale	
			Tejia	Pink and gray shale	
			Izegouanda	Pink coarse-grained arkose, with calcitic matrix, and lenses of tan-pink shale Microconglomerate (quartz, chert pebbles)	
Namur-Westphalian	Tagora		Arlit (10m)	Clayey sandstone, multicolored	
			Madaouela (50m)	Alternating gray to tan sandstone and gray-black shale with vegetal debris	Abakoroun
			Tarat (50m)	Coarse- to fine-grained quartzitic sandstone with shale lenses	
Visean Upper			UTT		
			Tschiniezogue (<70m)	Shale, argilieceous sandstone, quartzitic sandstone, greenish-gray	Arlit (Arlette, Ariège, Artois), Tassa/Arni
			Guézouman (<60m)	Medium- to coarse-grained quartzitic sandstone with clayey interbeds, light gray	
Visean Lower	Terada		Akokan Unit		
			Talak (180m)	Tan-black to blue-green shale, fine-grained, calcitic sandstone	Akouta, Afasto-Ouest, Madaouela
			Teragh (100m)	Coarse-grained sandstone silt, shale, multicolored	
	Precambrian - Lower Paleozic			Granite, metasediments	

Thickness values refer to the Arlit area.

They include:

Lower to Middle Carboniferous Tagora Group

- Upper Visean Guézouman Formation (Akouta deposit, Madaouela and Afasto-Ouest occurrences)
- Namur - Westphalian Tarat Formation (Arlit and Tassa N' Taghalgue/Arni deposits)
- Namur - Westphalian Madaouela Formation (Abakoroun deposit)

Jurassic Agadez Group

- Tchirézrine 2 Formation (Imouraren deposit, Assaouas occurrence)
- Gelili Sandstone in Assaouas Formation (Azelik deposit)

DEPOSITS IN PRODUCTION

Arlit

The Arlit project, located 250 km north of Agadez, is operated by Cogema. Uranium mining began in 1971, and ore has been mined from four open pits (**Figure 4**). Nominal production capacity of the Arlit mill is 6.0 million pounds U_3O_8 per year. Production peaked in 1981 at 5.5 million pounds U_3O_8, then was reduced to its present level of approximately three million pounds per year.

Geology and Mineralization

Uranium mineralization occurs within a 40 meter-thick sequence of alternating fine- to coarse-grained quartz sandstone, claystone-shale, and some conglomerate layers of the Carboniferous Tarat Formation. Individual bed sizes range from a few centimeters to ten meters thick. The strata dip subhorizontally, but with local variations. The principal rock facies is an often porous sandstone composed of quartz grains and a matrix of pyrite-bearing kaolinite-dickite and minor carbonate. Black shaley layers and lenses are intercalated in the sandstone. Vegetal organic material is abundant. These lithologies are part of an ancient river system termed the Arlit channel.

Uranium occurs in sandstone as pitchblende and coffinite, in shale as disseminated argillic-organic-uranium complexes, and in oxidized zones mainly as uranyl-vanadates. Minor amounts of molybdenum and vanadium also are present and are often closely associated with the uranium. The uranium mineralization is concentrated in the form of peneconcordant lenses or blankets with irregular boundaries in sandstone, black claystone and alternating beds of fine-grained sandstone and shale.

Figure 4
THE MINE-MILL COMPLEXES OF SOMAIR (ARLIT DEPOSIT) AND COMINAK (AKOUTA DEPOSIT)

© NUEXCO 1992

Three principal ore bodies are distinguished at Arlit: Arlette, Ariège, and Artois. They are separated from each other by barren ground or sub-ore grade mineralization. Their hanging walls are at a depth of 35 meters, 55 meters, and 80 meters, respectively (**Figure 5**). The ore bodies vary in thickness from 15 meters (Arlette) to 35 meters (Artois). Ore grade is almost 0.3 % U_3O_8. In addition, the Taza deposit, located nearby, was acquired from Société Miniere de Tassa N' Taghalgue (SMTT) in 1986. Production in the region has gradually shifted to this higher-grade, open-pit mine, and is now the Arlit project's predominant ore source. Total resources of the Arlit project, including that already mined, amount to almost 110 million pounds U_3O_8.

Akouta

The Akouta project is located about 10 kilometers from the Arlit project. Akouta is a 250-meter deep underground mine that began operation in 1978. Nominal production capacity of the mill is 5.2 million pounds equivalent U_3O_8 per year, with actual production equalling approximately 4.7 million pounds U_3O_8 per year plus 300 metric tons of molybdenum per year. Peak production of 5.9 million pounds U_3O_8 was achieved in 1981.

Geology and Mineralization

The Akokan channel, an ancient channel composed of sediments of the Carboniferous Guézouman Formation, is the host for the Akouta deposit. The channel is incised into the Akokan Unit with the deepest parts cutting through this unit into the underlying black shales of the Talak Formation. The basal part of the channel is filled with a conglomerate horizon (Teleflak conglomerate) ranging up to five meters thick. Pebbles consist of quartz, quartzite, granite, and rhyolite, suggesting an origin from the Aïr Massif. Black claystone and phosphatic pebbles occur in minor quantities.

A 35 meter-thick fluviatile sequence resting upon the Teleflak conglomerate is the principal host for the uranium mineralization. This unit is composed of lenses of coarse- and medium-grained quartz sandstones two to three meters thick, which grade laterally and vertically into fine-grained sandstone and claystone. The sands contain thin laminae of black clay with pyritized vegetal debris. Narrow channels up to 18 meters deep dissect the mineralized sandstone unit, and locally cut down into the Akokan Unit.

The principal uranium minerals are pitchblende and coffinite. They coat quartz grains and form tiny aggregates in phyllosilicates. Pitchblende sometimes pseudomorphoses organic matter with or without preserving the original vegetal texture. Associated minerals include molybdenum (up to 4800 parts per million—ppm), vanadium (<4000 ppm), zirconium (<600ppm), and zinc (<600 ppm). Pyrite is abundant, while marcasite, melnicovite, amorphous molybdenum-sulfide (jordisite), sphalerite (iron-poor), and galena occur in minor amounts. Molybdenum accompanies high-grade uranium in strongly reduced zones. Vanadium does not form discrete minerals but occurs bound in clay minerals. Zirconium is largely incorporated in pitchblende which contains three to five percent ZrO_2. This is reflected by the high degree of correlation between uranium and zirconium throughout the deposit.

Mineralization occurs in two principal configurations:

- strata peneconcordant lenses or blankets chiefly associated with coarse- and medium-grained sandstone horizons;
- fault controlled, vertically stacked ore bodies.

Lenses are from several centimeters to a few meters thick, several meters to some ten meters wide, and up to a few hundred meters long. Stacked ore is up to 18 meters thick. Several lenses or blankets may occur superjacent to each other within a 25-meter thick lithologic profile. Ore grade at Akouta is almost 0.5 % U_3O_8; total resources, including that already mined, exceed 150 million pounds U_3O_8.

OTHER DEPOSITS IN THE TIM MERSOÏ BASIN

Niger has numerous other undeveloped deposits, all within the Tim Mersoï basin. Onarem has an interest in all Niger's uranium projects, and Cogema is also a major shareholder in most of the deposits. Additionally, organizations from Japan, Germany, Kuwait, and the United Kingdom have varying interests in some of the projects.

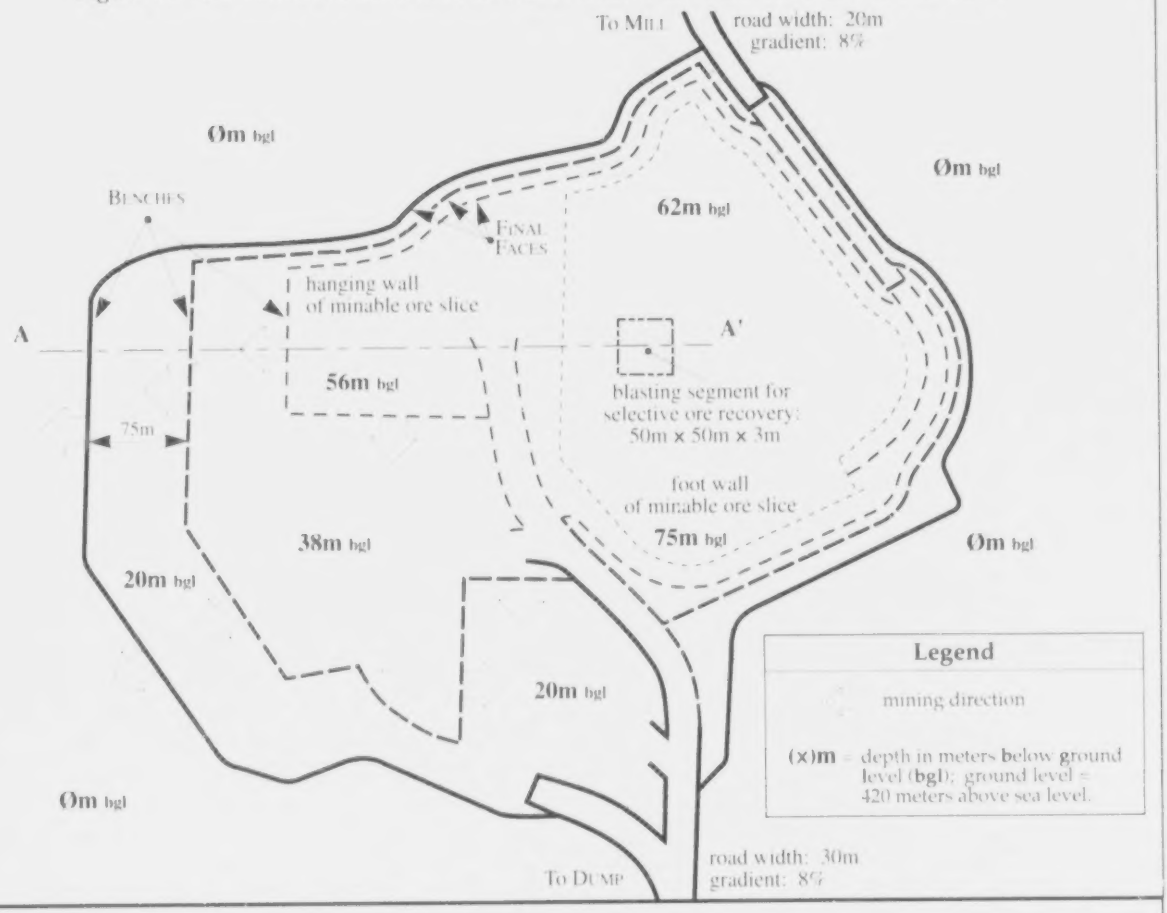
Carboniferous Tagora Group

Madaouela

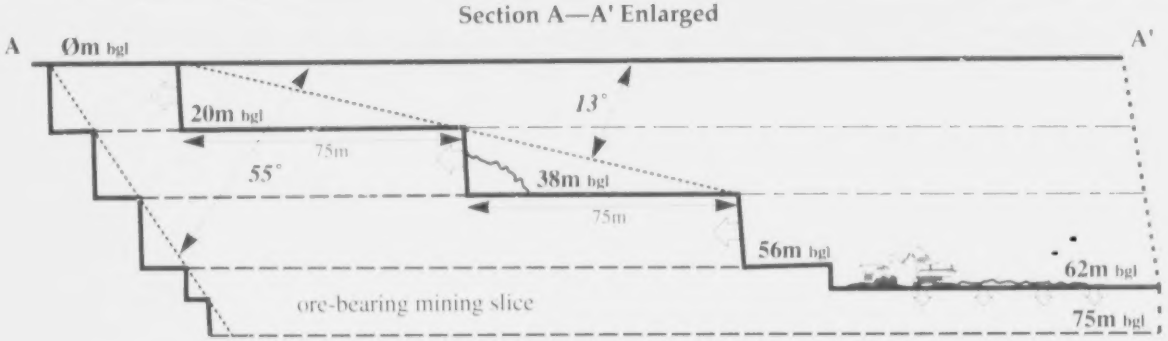
The Madaouela deposit is located about 30 km southeast of Arlit. Two ore bodies, 300 meters apart, have been identified: Marianne and Marylin. Host rocks are sandstone and the Teleflak conglomerate of the Guézouman Formation. The sandstone consists of fine-grained quartz grains without cement and contains abundant pyrite and organic matter.

© NUEXCO 1992

Figure 5 — SCHEMATIC OF MINING METHODS USED AT THE ARLIT PROJECT



Section A—A' Enlarged



These diagrams illustrate the open-pit mining methods used at the Arlette and Ariège deposits at the Arlit project. Blasting of the mineralized horizon is done in benches 50 meters wide, 50 meters long, and 3 meters high. Ore-grade material is selected by radiometric survey of short holes in a 2.5m x 2.5m grid. Ore calculation is done in slices 5m x 5m and 0.2m thick. Based on this data, ore is recovered by selective blasting of ore-grade and subgrade material. Approximately 40 to 50 tonnes of the mining slice will yield 14-15 tonnes of ore that can be transported to the mill.

© NUEXCO 1992

Uranium occurs in reduced zones as pitchblende and coffinite, closely associated with organic material. Associated minerals include sulfides of iron, molybdenum, zinc, lead, and copper. Mineralization occurs primarily as elongated lenses restricted to the basal part of the Guézouman Formation, where they rest immediately above pyritic gray to black shale of the Talak Formation. The mineralized horizon is at a depth of 40 to 120 meters below the surface. Madaouela resources total 17 million pounds U_3O_8, but recovery costs are estimated at more than $30 per pound U_3O_8.

Tassa N' Taghalgue/Arni

This deposit is located only four kilometers from Arlit. Host rocks are quartz sandstones of the Tarat Formation. Mineralization occurs at a depth of 80 meters and could be mined by open-pit methods. Resources totalling 148 million pounds U_3O_8 at a grade of 0.29 %U_3O_8 could be recovered at less than $30 per pound U_3O_8.

Afasto-Ouest

The deposit, located 15 km south of Arlit, is hosted by quartz sandstones of the Guézouman Formation. Mineralization occurs at a depth of approximately 800 meters and would require underground mining. It is estimated that resources exceeding 80 million pounds U_3O_8 at a grade of 0.29 %U_3O_8 could be recovered at a cost greater than $30 per pound U_3O_8.

Sekiret

Host rocks to the Sekiret deposit are arenaceous sediments of the Tagora Group. Mineralized sandstone lenses up to 2.9 meters thick occur at a depth of 200 meters. Resources of this deposit, located 50 km south of Arlit, amount to ten million pounds U_3O_8 at an average grade of 0.13 %U_3O_8. Recovery costs probably would exceed $30 per pound U_3O_8.

Abakoroun

The uranium of this deposit, located 200 km southwest of Arlit, is hosted in sandstones of the middle part of the Madaouela Formation. No resource figures on this deposit are published individually, but are combined with figures from the Azelik deposit.

Jurassic Agadez Group

Imouraren

The Imouraren deposit, the largest undeveloped deposit in Niger, is hosted by largely oxidized arkoses of the Upper Jurassic Tchirézrine 2 Formation. The arkoses contain zeolites but very little argillaceous matrix, and organic matter is rare. The zeolites, essentially analcime, occur finely disseminated or accumulated in layers. Fractures are filled with a kaolinite-dickite assemblage.

Principal uranium minerals are uranophane, boltwoodite, and metatyuyamunite. Associated minerals include a relatively high content of native copper and copper oxides. Limited reduced zones occur as remnants in the sediments and contain predominantly coffinite associated with native copper or chalcocite. Pitchblende is rare and accompanied by chalcopyrite.

Mineralization at this deposit, located 80 km south of Arlit, occurs in three zones over a vertical interval of 50 meters. Overburden thickness is between 100 and 110 meters. Resources total over 200 million pounds U_3O_8 at a grade of about 0.18 %U_3O_8, recoverable at an estimated cost of more than $30 per pound U_3O_8. Lower grade resources total an additional 65 million pounds U_3O_8.

Assaouas

Assaouas is a uranium occurrence in the oxidized arkoses of the Tchirézrine 2 Formation. Geologically and mineralogically, it is similar to Imouraren except that the coffinite-chalcocite association occurs in zones with remnants of "primary" hematite.

Azelik

Azelik is located about 140 km southwest of Arlit. Mineralization occurs in the Gelili sandstone which forms intercalated lenses and beds up to six meters thick within the pink clays of the Assaouas Formation. Two varieties of mineralization are distinguished. Pitchblende exists in reduced zones; it coats quartz grains and occurs as isolated aggregates in calcitic matrix or on cleavage planes of feldspar. Coffinite associates with native copper.

© NUEXCO 1992

In oxidized zones, two generations of uranophane prevail: francevillite and other hexavalent uranium species. Associated minerals are manganese-oxides, hematite, baryte, and rare sulfide.

Combined resources for the Azelik and Abakoroun deposits total 25 million pounds U_3O_8 recoverable at costs estimated at less than $30 per pound U_3O_8, and over 10 million pounds U_3O_8 at greater than $30 per pound U_3O_8. Grades range from 0.20 to 0.25 %U_3O_8.

CONCLUSION

Uranium mining is the single most important industry in the country of Niger. Its uranium resources are abundant but costly to mine. However, given uranium's importance in the country's economy, France, primarily through Cogema, likely will continue to purchase its former colony's uranium at higher prices, thereby preserving its interests in Niger and supporting the democratic moves by the country.

© NUEXCO 1992

NUCLEAR INDUSTRY CALENDAR

1992

March 22-25 ***Fuel Cycle Conference '92*** (OMNI Charleston Hotel, Charleston, South Carolina).
Sponsored by the U.S. Council for Energy Awareness.
Contact: USCEA Conference Office; 202-293-0770; Telex: 7108249602; Fax: 202-785-4113.

April 8-10 ***Research and Development in the Nuclear Industry*** (Peterhouse, University of Cambridge, England).
Sponsored by the Institution of Nuclear Engineers and the British Nuclear Forum.
Contact: Ms. Ipek Yigit, Manager for Public and Industrial Affairs, British Nuclear Forum; phone: 071-828-0116; Fax: 071-828-0110; Address: 22 Buckingham Gate, London, SW1E 6LB, England.

April 8-10 ***25th Japan Atomic Industrial Forum Conference*** (Pacifico Yokohama, Yokohama, Japan).
Contact: Department of Planning and International Affairs, Japan Atomic Industrial Forum, Inc., 81-3-3508-2411; Fax: 81-3-3508-2094; Address: 1-1-13 Shimbashi, Minato-ku, Tokyo 105, Japan.

April 12-16 ***8th Pacific Basin Conference*** (Taipei, Taiwan).
Sponsored by the American Nuclear Society.
Contact: ANS Meetings Department; 708-352-6611.

April 12-16 ***3rd Annual International High-Level Radioactive Waste Management Conference***
(Mirage Hotel, Las Vegas, Nevada).
Sponsored by the American Society of Civil Engineers.
Contact: ASCE; 212-705-7543; Address: 345 East 47th Street, New York, New York 10017.

April 26-28 ***INFO '92 Conference*** (OMNI Charlotte Hotel, Charlotte, North Carolina).
Sponsored by the U.S. Council for Energy Awareness.
Contact: USCEA Conference Office; 202-293-0770; Telex: 7108249602; Fax: 202-785-4113.

May 4-6 ***Nuclear Power Assembly '92*** (Capitol Hill Hyatt Regency, Washington, DC).
Sponsored by the American Nuclear Energy Council.
Contact: Diane Holmes; 202-484-2670

May 5-7 ***Annual Meeting on Nuclear Technology '92*** (City Conference Hall, Karlsruhe, Germany).
Sponsored by the German Nuclear Society and the German Atomic Forum.
Contact: Congress Office JK'92; INFORUM GmbH, Heussallee 10, W-5300 Bonn 1; Phone: 0228-507-223.

May 17-19 ***19th Annual Meeting & Int'l Conference on Nuclear Energy*** (Hotel Diplomat, Prague, Czech.).
Sponsored by World Nuclear Fuel Market.
Contact: Donna Cason; 404-447-1144; Fax: 404-447-1797.

© NUEXCO 1992

NUEXCO

CALENDAR

1992
(continued)

June 7-11 ***American Nuclear Society Annual Meeting*** (Boston Marriott, Copley Place, Boston, Massachusetts).
Contact: ANS Meetings Department; 708-352-6611.

June 23-24 ***Nuclear Forum '92*** (Royal Garden Hotel, London, United Kingdom).
Sponsored by the British Nuclear Forum.
Contact: Ms. Ipek Yigit, Manager for Public and Industrial Affairs, British Nuclear Forum; phone: 071-828-0116; Fax: 071-828-0110; Address: 22 Buckingham Gate, London, SW1E 6LB, England.

Sept. 9-11 ***Uranium Institute 17th Annual Symposium*** **(London, United Kingdom).**
Contact: 44-71-225-0303; Fax: 44-71-225-0308.

Sept. 20-23 ***International Uranium Seminar '92*** (Hyatt Regency Hotel, Lake Tahoe, Nevada).
Sponsored by the U.S. Council for Energy Awareness.
Contact: USCEA Conference Office; 202-293-0770; Telex: 7108249602; Fax: 202-785-4113.

Sept. 21-23 ***2nd International Conference on Training for Operation & Maintenance in the Nuclear Industry***
(The Moat House International Hotel, Stratford-upon-Avon, United Kingdom).
Sponsored by the Institution of Nuclear Engineers.
Contact: INE Conference Secretary; 081-698-1500 or 081-698-4750; Fax: 018-695-6409.

Sept. 29-Oct. 1 ***Crisis/Emergency Information Planners' Workshop*** (Loews L'Enfant Plaza, Washington DC)
Sponsored by the U.S. Council for Energy Awareness.
Contact: USCEA Conference Office; 202-293-0770; Telex: 7108249602; Fax: 202-785-4113.

Oct. 18-22 ***AMC Mining Convention*** (Las Vegas, Nevada)
Sponsored by the American Mining Congress.
Contact: AMC Convention Office; 202-861-2800; Fax: 202-861-7535.

Oct. 19-23 ***International Symposium on Geological Disposal of Spent Fuel, High-level and Alpha-bearing Wastes***
(Antwerp, Belgium).
Sponsored by the International Atomic Energy Agency.
Contact: IAEA, P. O. Box 100, A-1400 Vienna, Austria.

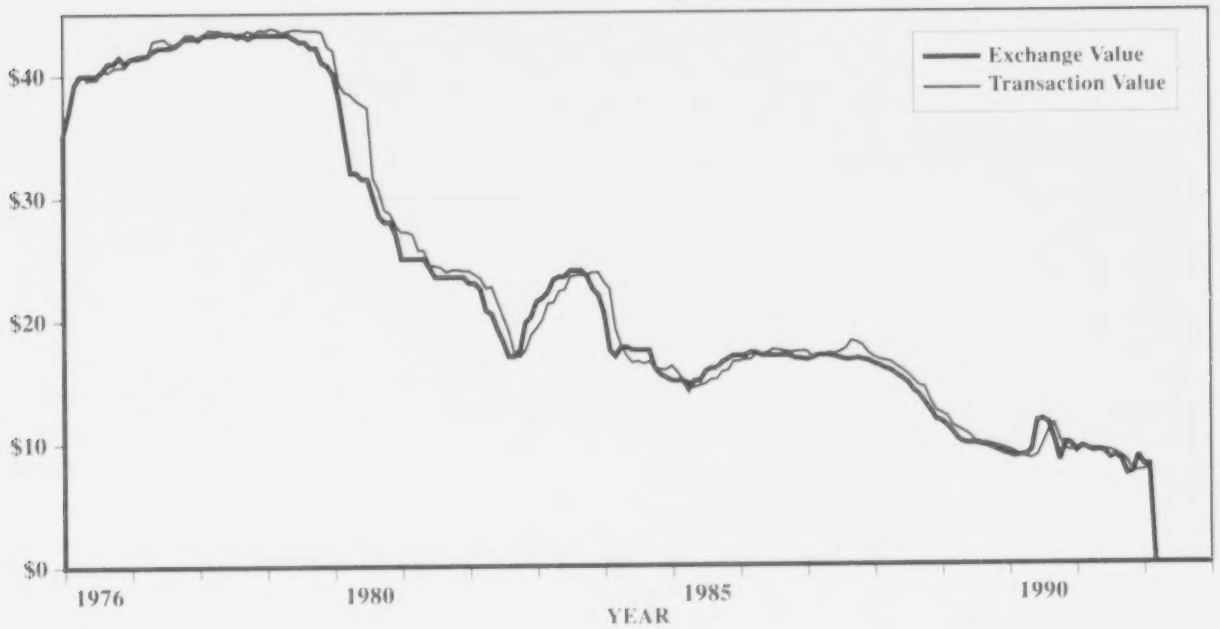
Nov. 15-18 ***International Nuclear Energy Forum*** (Fairmont Hotel, Chicago, Illinois).
Sponsored by the U.S. Council for Energy Awareness.
Contact: USCEA Conference Office; 202-293-0770; Telex: 7108249602; Fax: 202-785-4113.

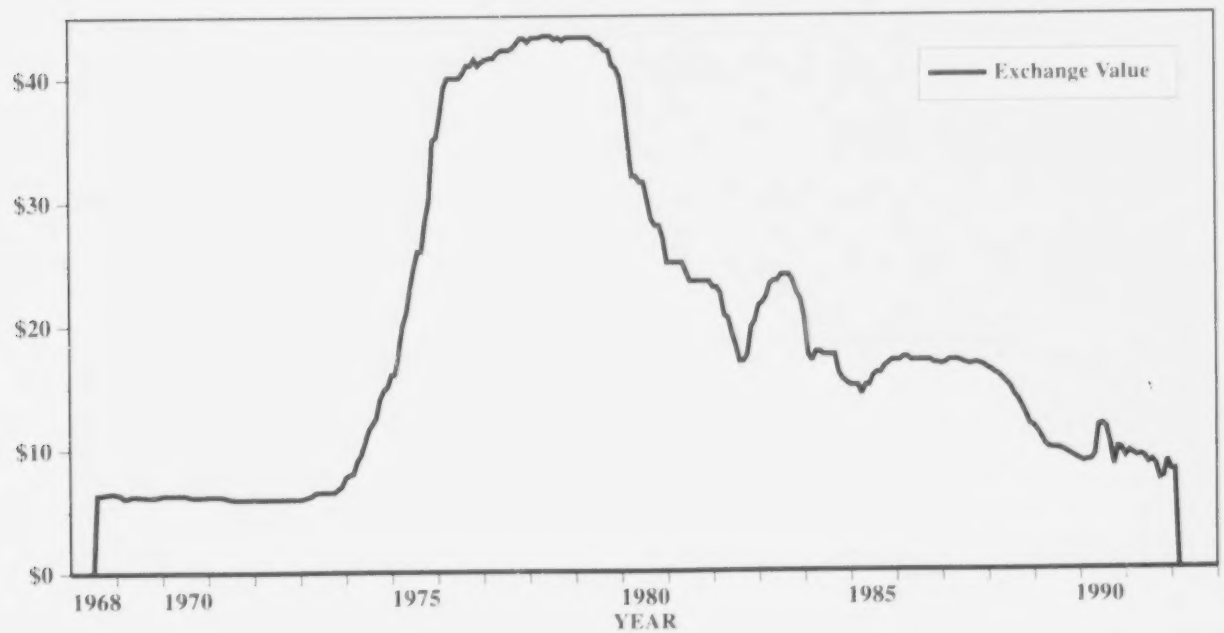
Nov. 15-20 ***American Nuclear Society Winter Meeting*** (McCormick Center Hotel, Chicago, Illinois).
Contact: ANS Meetings Department; 708-352-6611.

© NUEXCO 1992

NUEXCO HISTORICAL EXCHANGE VALUE AND TRANSACTION VALUE

(in US dollars per pound U_3O_8)





© NUEXCO 1992

NUEXCO

HISTORICAL MARKET DATA

HISTORICAL MARKET VALUES

Exchange Values

Year	Determined as of the last day of the month indicated ($US/lb U3O8)											
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00
1990	8.85	8.70	8.80	8.80	9.25	11.60	11.70	11.45	10.10	8.35	9.80	9.70
1991	9.10	9.50	9.30	9.10	9.20	9.05	8.55	8.75	8.40	7.25	7.40	8.75
1992	8.00	**8.00**										

US Premium (Relative to the Exchange Value)

Year	Determined as of the last day of the month indicated ($US/lb U3O8)											
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	**Discontinued**	

© NUEXCO 1992

UF_6 Values

Determined as of the last day of the month indicated ($US/kg U as UF_6)

Year	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50
1990	25.90	25.25	24.40	24.40	25.50	32.00	32.50	32.25	29.50	24.75	28.75	28.75
1991	27.50	27.75	27.50	27.25	27.60	27.25	25.75	26.25	25.50	22.75	22.75	26.00
1992	24.50	**24.25**										

US Premium (Relative to the UF_6 Value)

Determined as of the last day of the month indicated ($US/kg U as UF_6)

Year	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	**Discontinued**	

Conversion Values

Determined as of the last day of the month indicated ($US/lb U as UF_6)

Year	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65
1990	1.50	1.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45
1991	1.45	1.45	1.45	1.45	1.50	1.50	1.50	1.60	1.55	1.55	1.55	1.55
1992	1.60	**1.60**										

© NUEXCO 1992

NUEXCO

HISTORICAL MARKET DATA

Transaction Values

Year	Determined as of the last day of the month indicated ($US/lb U_3O_8)											
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40
1990	9.25	9.05	8.75	8.65	8.55	8.80	9.75	10.80	11.40	10.10	9.30	9.15
1991	9.40	9.45	9.35	9.30	9.30	9.20	9.15	8.95	8.70	8.35	7.45	7.50
1992	7.55	**7.80**										

SWU Values

Year	Determined as of the last day of the month indicated ($US per SWU)											
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54
1990	54	50	50	50	50	50	50	50	50	51	51	51
1991	51	50	52	52	54	59	66	67	67	68	68	70
1992	71	**70**										

© NUEXCO 1992

Loan Rates

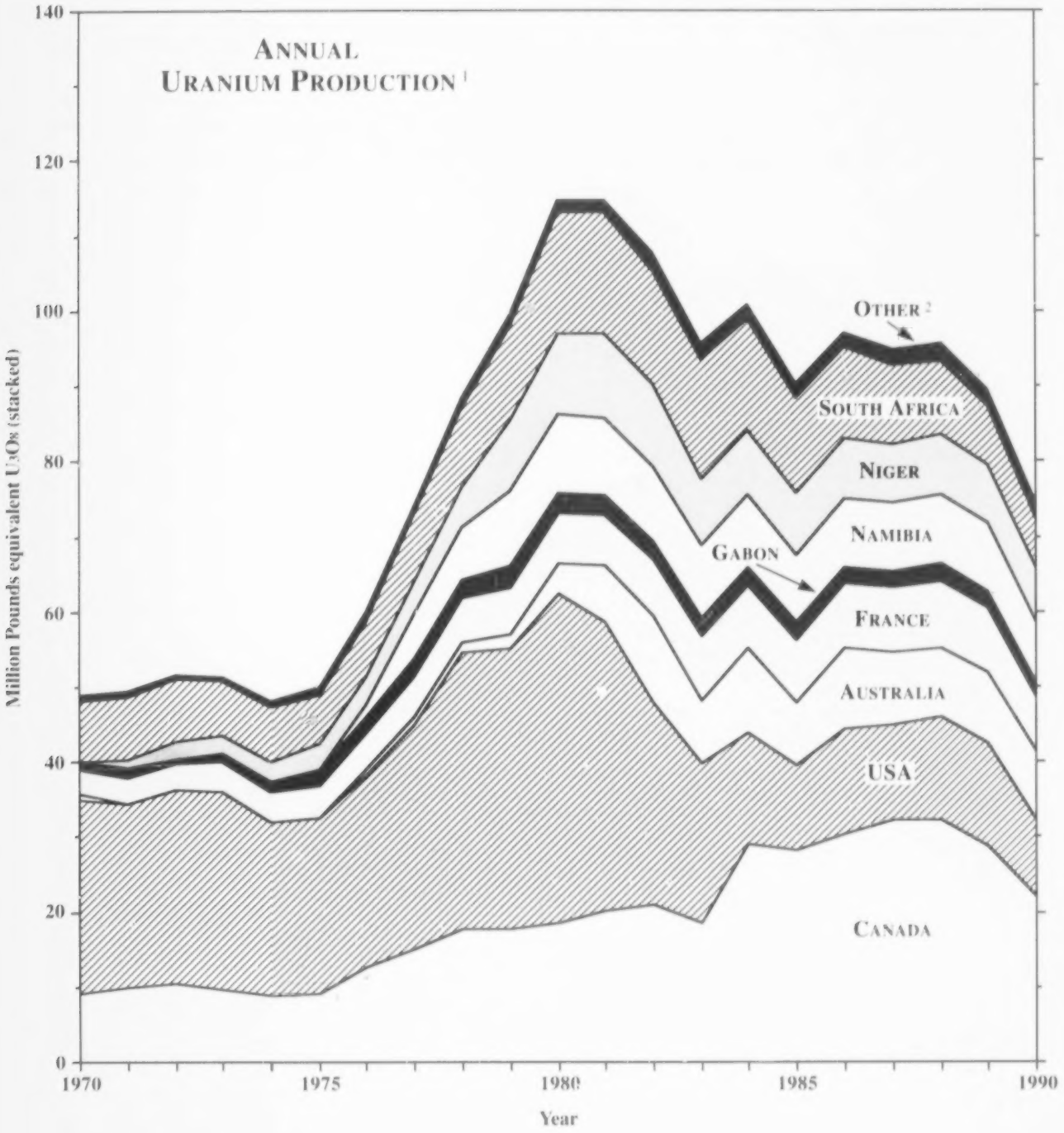
Year	Determined as of the last day of the month indicated (Percent per Annum)											
	Jan	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1990	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1991	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.00
1992	3.00	**3.00**										

* Float with Prime Rate

© NUEXCO 1992

NUEXCO

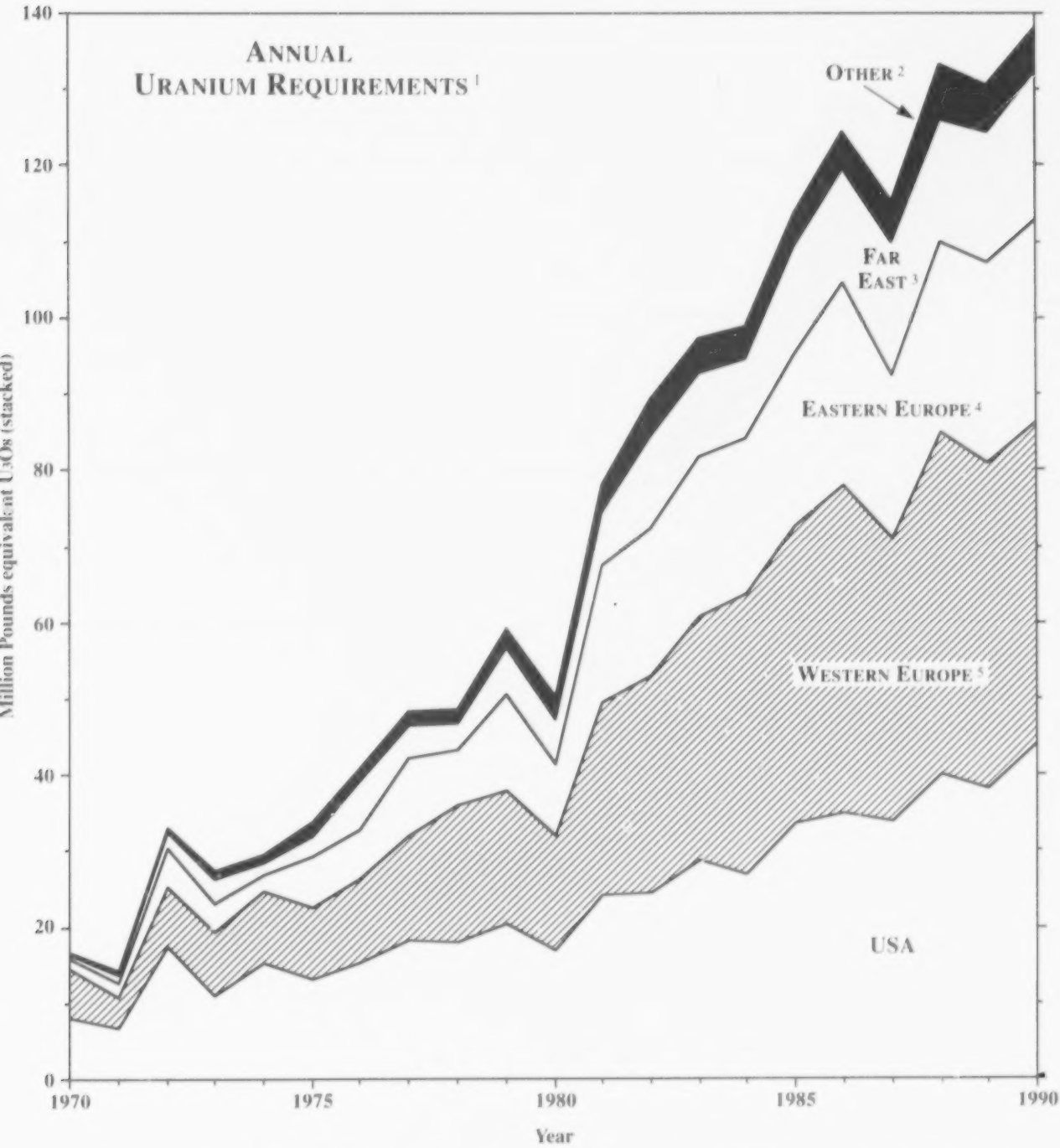
HISTORICAL MARKET DATA



[1] Estimated western world uranium production in 1990 totalled 74.5 million pounds equivalent U_3O_8 — (Australia: 9.1 – Canada: 22.0 – France: 7.4 – Gabon: 1.8 – Namibia: 8.0 – Niger: 7.4 – South Africa: 6.4 – USA: 10.2 – Other [2]: 2.2)

[2] **Other** includes: Argentina, Belgium, Brazil, India, Pakistan, Portugal, Spain, former West Germany, and Yugoslavia (Slovenia)

© NUEXCO 1992



[1] Calculated by NUEXCO based on actual completion dates and operating performance, and NUEXCO's estimate of enriching tails assay.
[2] **Other** includes: Argentina, Brazil, Canada, India, Mexico, Pakistan, and South Africa.
[3] **Far East** includes: Japan, People's Republic of China, South Korea, and Taiwan.
[4] **Eastern Europe** includes: Bulgaria, Czechoslovakia, former East Germany, Finland, Hungary, former Soviet Union, and Yugoslavia (Slovenia).
[5] **Western Europe** includes: Belgium, France, former West Germany, Italy, The Netherlands, Spain, Sweden, Switzerland, and UK.

© NUEXCO 1992

NUEXCO

GOVERNMENT STATISTICS

Australia

Year	Period [1]	Consumer Price Index [2] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups [3] (1984/1985 = 100)	Average Weekly Ordinary Time Earnings — Adult Males — Australia [4] (Australian dollars)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates [5] (June 1985=100)
1980	Avg.	95.8	83.1	—	69.6
1981	Avg.	105.0	85.9	—	76.1
1982	Avg.	116.7	89.0	—	86.4
1983	Avg.	128.5	96.9	—	89.9
1984	Avg.	133.6	98.0	—	96.0
1985	Avg.	142.6	107.3	—	100.0
1986	Avg.	155.5	101.5	—	104.9
1987	Avg.	168.7	108.9	465.88	112.9
1988	Avg.	180.9	111.8	496.90	115.4
1989	Avg.	194.6	117.0	534.65	126.0
1990	Avg.	208.7	123.4	571.43	129.7
1991	Avg.	215.5	120.1	—	—
Jan	1991	—	125.6	—	130.9
Feb	1991	—	121.5	597.70	130.9
Mar	1991	214.1	119.1	—	131.2
Apr	1991	—	117.6	—	131.4
May	1991	—	117.8	592.00	131.4
June	1991	214.4	120.4	—	131.4
July	1991	—	120.4	—	131.4
Aug	1991	—	119.9	599.50	131.7
Sept	1991	215.7	118.3	—	132.0
Oct	1991	—	118.7	—	132.0
Nov	1991	—	120.6	—	132.0
Dec	1991	217.7	121.2	—	—

P = Preliminary **R** = Revised since last month

[1] Monthly data for the period 1967 to 1990 appears in Report 278.

[2] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 = 100.0). Figures shown at end of quarter represent quarterly average.

[3] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).

[4] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.

[5] Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).

© NUEXCO 1992

Canada

		Industrial Products Price Index: All Commodities [1] (1986 = 100) [2]	Consumer Price Index: All Items (1986 = 100) [3]	Wage-earner Data: Average Hourly Earnings (C$) [4] Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	75.9	67.2	—·—	—·—	—·—	—·—	—·—
1981	Avg.	83.6	75.5	—·—	—·—	—·—	—·—	—·—
1982	Avg.	89.0	83.7	—·—	—·—	—·—	—·—	—·—
1983	Avg.	92.1	88.5	17.22	14.86	14.18	10.67	11.09
1984	Avg.	96.3	92.4	17.89	15.85	14.97	11.11	11.68
1985	Avg.	99.0	96.0	18.53	16.47	15.56	11.85	12.12
1986	Avg.	100.0	100.0	19.38	16.70	15.76	12.28	12.58
1987	Avg.	102.8	104.4	20.12	17.15	16.11	12.58	13.20
1988	Avg.	107.2	108.6	20.91	18.51	16.95	13.17	13.77
1989	Avg.	109.4	114.0	21.97	20.02	18.41	13.71	14.16
1990	Avg.	109.7	119.4	22.90	20.93	19.12	14.62	15.28
1991	Avg.	108.7	126.2	24.32P	22.25P	20.29P	14.83P	16.45P
Jan	1991	111.1	125.0	23.79	21.79	19.78	14.66	15.89
Feb	1991	110.6	125.0	25.23	22.45	20.13	14.63	16.10
Mar	1991	109.8	125.5	24.19	22.22	20.27	15.21	16.47
Apr	1991	109.1	125.5	24.77	22.50	20.31	14.63	16.65
May	1991	108.6	126.1	24.38	22.17	20.25	15.05	16.55
June	1991	108.5	126.7	23.58	22.13	19.90	14.65	16.51
July	1991	108.2	126.8	24.70	22.33	19.93	14.56	16.36
Aug	1991	107.8	126.9	23.78	22.01	20.00	14.62	16.24
Sept	1991	107.6	126.7	24.23	22.27	20.38	14.89	16.47
Oct	1991	107.6	126.5	24.40	22.26	20.53	15.06	16.55
Nov	1991	107.5	127.0	24.58R	22.44R	20.79R	14.85R	16.62R
Dec	1991	107.6	126.4	24.27P	22.46P	21.00P	15.13P	17.05P
Jan	1992	107.7	127.0	—·—	—·—	—·—	—·—	—·—

P = Preliminary **R** = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1990 is found in Report 278.

[2] New Base Year of 1986 as of Report 266. Previous Base Year was 1981.

[3] New Base Year of 1986 as of Report 264. Previous Base Year was 1981.

[4] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1990 is found in Report 278.

© NUEXCO 1992

NUEXCO

GOVERNMENT STATISTICS

South Africa

		Average Declared Working Costs per Metric Ton of Gold Ore Milled [1] (Rand)	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled [2] (March 1982 = 100)	Consumer Price Index [3] (1990 = 100)	Production Price Index All Groups [4] (1985 = 100)	Total Employment in Mining and Quarrying [5]	Total Salaries and Wages in Mining and Quarrying [5] (1,000 Rand)
							Annual Total [6]
1980	Avg.	35.50	—	25.5	55.2	709,042	2,237,689
1981	Avg.	41.87	—	29.4	62.7	722,918	2,756,928
1982	Avg.	47.23	103.9	33.7	71.4	702,041	3,181,584
1983	Avg.	51.88	115.0	37.8	79.0	700,901	3,563,282
1984	Avg.	58.95	130.3	42.2	85.6	711,511	4,134,390
1985	Avg.	68.70	151.7	49.1	100.0	724,587	4,778,612
1986	Avg.	80.18	177.9	58.2	119.6	756,637	5,767,950
1987	Avg.	95.01	223.1	67.6	136.2	751,864	6,911,395
1988	Avg.	106.69	241.1	76.2	154.1	705,355	7,774,054
1989	Avg.	116.65	273.0	87.4	177.5	700,360	8,833,934
1990	Avg.	129.37	305.3	100.0	198.9	677,742	10,193,209
1991	Avg.	136.06	324.5	115.2	221.6	—	—
							Monthly Total
Jan	1991	—	—	107.7	216.1	648,944	935,839
Feb	1991	—	—	109.0	216.9	650,948	893,373
Mar	1991	137.66	323.82	110.0	215.3	651,843	924,930
Apr	1991	—[P]	—	111.5	216.5	639,939	887,722
May	1991	—	—	113.2	218.4	630,481	887,107
June	1991	134.65	317.23	114.0	219.3	640,908	890,595
July	1991	—	—	115.5	221.2	637,581	881,182
Aug	1991	—	—	117.1	222.8	633,699 R	963,710 R
Sept	1991	137.11	329.05	118.7	225.2	639,535 R	1,014,424 R
Oct	1991	—	—	119.8	228.3	580,942	853,933
Nov	1991	—	—	122.2	229.4	—	—
Dec	1991	134.81	327.83	123.8	230.3	—	—
Jan	1992	—	—	125.1	—	—	—

P = Preliminary **R** = Revised since last month

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 278.

[2] Page 16 of Report 178 contains description and calculation of index.

[3] Central Statistical Service, Pretoria: All income groups-weighted average. Historical Data by month appears in Report 278.

[4] Central Statistical Service, Pretoria: All commodities for consumption in South Africa.

[5] Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.

[6] Annual total is shown, rather than monthly average, for indicated year.

© NUEXCO 1992

United States

		Producer Price Index [1]		Consumer Price Index [2]	GNP Implicit Price Deflator [3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$) [4]			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	(1982-1984 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.31	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.66
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.57	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.3	13.24	13.26	12.71	9.79
1989	Avg.	111.6	112.2	124.0	126.3	13.59	13.72	13.09	10.05
1990	Avg.	115.8	116.3	130.7	131.5	14.10	14.36	13.54	10.32
1990	Avg.	116.5	116.5	136.2	—	14.89 P	14.64 P	14.07	10.73
Jan	1991	119.3	119.0	134.6	—	14.73	14.63	13.85	10.60
Feb	1991	117.2	117.2	134.8	—	14.80	14.55	13.81	10.59
Mar	1991	115.6	116.1	135.0	134.8	14.93	14.55	13.85	10.55
Apr	1991	115.6	116.0	135.2	—	14.85	14.56	13.96	10.63
May	1991	116.1	116.5	135.6	—	14.79	14.52	14.01	10.66
June	1991	116.1	116.4	136.0	136.1	14.88	14.51	14.05	10.74
July	1991	116.0	116.1	136.2	—	15.09	14.56	14.16	10.77
Aug	1991	116.3	116.2	136.6	—	14.82	14.64	14.06	10.78
Sept	1991	116.3 R	116.1 R	137.2	136.9	15.04	14.59	14.21	10.84
Oct	1991	116.6	116.4	137.4	—	14.94	14.75	14.25	10.78
Nov	1991	116.7	116.4	137.8	—	15.29 R	14.89 R	14.27 R	10.88 R
Dec	1991	116.1	115.9	137.9	—	14.52 P	14.87 P	14.35 R	10.96 R
Jan	1992	115.6	115.6	138.1	—	14.71 P	—	14.37 P	10.90 P

P = Preliminary **R** = Revised since last month

[1] US Bureau of Labor Statistics, Washington, DC: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents Historical data is presented in Report 278.

[2] US Bureau of Labor Statistics, Washington, DC: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 278.

[3] US Department of Commerce, Washington, DC: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 278.

[4] US Bureau of Labor Statistics, Washington, DC: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 278.

© NUEXCO 1992

NUEXCO

GOVERNMENT STATISTICS

Volume and Price of Uranium Deliveries To The European Community [1]

— Compiled from data published by the Euratom Supply Agency —

Year	Volume of Deliveries to the EC [2] (MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts [3] Average Price		Spot Contracts [3] Average Price	
			in ECU per pound U_3O_8	in US Dollars per pound U_3O_8	in ECU per pound U_3O_8	in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75
1987	14,000	17.0	ECU 28.25	$32.50	ECU 15.00	$17.25
1988	12,500	4.5	ECU 26.92	$31.82	ECU 13.65	$16.13
1989	13,500	11.5	ECU 26.63	$29.35	ECU 11.04	$12.19
1990	12,800	16.7	ECU 23.08	$29.39	ECU 7.60	$ 9.68

P = Preliminary **R** = Revised since last month

[1] The twelve European Community member nations are Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar. Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

© NUEXCO 1992

US Uranium Marketing Activities Statistics

— Compiled from data published by the US Energy Information Administration [1] —

Year	Total Production (million pounds U_3O_8)	Deliveries to Domestic Utilities From US Suppliers [2] (million pounds U_3O_8)	Average Price of Delivered Uranium [2] ($/lb. U_3O_8)	Quantity of Uranium Imported [3] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	27.6	$16.10	3.6	n/a	1.2
1977	29.9	27.8	$19.75	5.6	n/a	4.0
1978	37.0	31.6	$21.60	5.2	n/a	6.8
1979	37.5	33.0	$23.85	3.0	n/a	6.2
1980	43.7	35.0	$28.15	3.6	$43.10	5.8
1981	38.5	32.6	$34.65	6.6	$32.90	4.4
1982	26.9	23.5	$38.37	17.1	$25.19	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6
1987	13.0	20.8	$27.37	15.1	$19.14	1.0
1988	13.1	17.6	$26.15	15.8	$19.03	3.3
1989	13.8	18.4	$19.56	13.1	$16.75	2.1
1990	8.9	20.5	$15.70	23.7	$12.55	2.0

P = Preliminary **R** = Revised since last month

[1] Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity*.
1984-1990: Energy Information Administration, *Uranium Industry Annual*.

[2] Data for 1976-1981 includes both domestic utilities and agents.

[3] Includes imports by domestic utilities and domestic suppliers.

© NUEXCO 1992

NUEXCO

INTERNATIONAL ADVISORY COMMITTEE

J. Robert (Bob) Wolcott
Chairman
USA

* * *

Lars Halle
Sweden

O. J. C. (John) Runnalls
Canada

George J. Stathakis
USA

James C. C. Stewart
United Kingdom

W. Bryan Webster
USA

Ken C. Whyte
South Africa

REPRESENTATIVES

JAPAN:

Kazuo Yokota
Japan Tech Services
Ohkura Building (3F)
1–4–10 Shiba Daimon
Minato-ku, Tokyo 105, Japan
Telephone: (81-3) 3431-6031, -6034
Fax: (81-3) 3434-6674
Telex: 242-5060 (JATECH J)

SOUTH AFRICA:

Chris I. Von Christierson
Southern Prospecting (Pty) Limited
Mailing Address:
Post Office Box 61409
Marshalltown 2107
Republic of South Africa
Street Address:
7th Floor, Marshall Place
66 Marshall Street
Johannesburg 2001
Telephone: (27-11) 834-4211
Fax: (27-11) 834-6343
Telex: 4-89878-SA

TAIWAN:

Dr. Steve H.K. Wang
Southeast Engineering Corporation
Yu-Ming Mansion
7, Roosevelt Rd., Sec. 1, 7th Floor
Taipei, 10757, Taiwan R.O.C.
Telephone: (886-2) 321-0216
Fax: (886-2) 394-2621
Telex: 11285 (SENCORP)

UNITED STATES:

Harold C. Lindberg
83-A Hardee Lane
Whispering Pines, North Carolina 28327
Telephone: (919) 949-3622
Fax: (919) 949-2626

Ralph O. Smith
141 Braemar Drive
Cheshire, Connecticut 06410
Telephone: (203) 272-6246
Fax: (203) 271-1346

© NUEXCO 1992

INTERNATIONAL HEADQUARTERS

Three Park Central, Suite 1000
1515 Arapahoe Street
Denver, Colorado 80202 USA

Telephone: (303) 899-4500
Fax: (303) 899-4555
Telex: 450202/NUEXCO